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DETERMINATION OF ANTIMICROBIAL POTENTIAL OF SELECTED PLANTS GROWING IN POLLUTED AND NON-POLLUTED AREAS OF KURUKSHETRA DISTRICT, HARYANA, INDIA

Neelakshi, Research Scholar, School of Life Sciences, Singhania University, Pacher Bari, Jhunjhunu, Rajasthan
Dr.Sumer Singh, Associate Professor, School of Life Sciences, Singhania University, Pacher Bari, Jhunjhunu, Rajasthan

Abstract

In the present study, the antimicrobial activities of different plants like *Polyalthia longifolia, Azadirachta indica, Dalbergia sisso, Ficus benghalensis* and *Ficus religiosa* were studied at polluted and non polluted sites and results were compared. The antimicrobial activity of leaf extracts were analysed using disc diffusion method. It was observed that the methanol extracts of *Polyalthia longifolia, Azadirachta indica, Dalbergia sisso, Ficus benghalensis* and *Ficus religiosa*growing in polluted sites showed higher antimicrobial activity as compared to non polluted sites.*Azadirachta indica* was most potent extract against microbes in both polluted and non polluted sites.

Introduction

Due to the emergence of multidrug resistant (MDR) strains and the unfavourable side effects of commercial medications, there is a growing interest in discovering botanicals as natural antimicrobial agents (Bartfay et al., 2012; Qasim et al., 2019). Due to the production of secondary metabolites like phenols and flavonoids, which are important in the interactions between plants and their environment (Muhammad et al., 2015; Qasim et al., 2017; Rhodes, 1994), plants growing under stress may have higher activities (Basile et al., 2010; Nadir et al., 2013; Schippmann et al., 2002). According to studies (Basile et al., 2010, Rezanejad, 2009, Chan, M.W.H., 2021) such substances seem to be associated with high bioactivities in plant extracts in response to pollution stress.As a result of physiochemical adaptations to survive under stress, environmental stress may cause biochemical changes in plants that lead to the formation of bioactive secondary chemicals (Basile et al., 2010; Rezanejad, 2009). The present study deal with comparison of antimicrobial activity of leaf extracts of plants like *Polyalthialongifolia, Azadirachtaindica, Dalbergia sissoo, Ficus benghalensis*and *Ficusreligiosa*, growing in polluted and non-polluted sites.

Materials and Methods

Plant Material Collection

The leaves sample of few selected plants like *Polyalthialongifolia*, *Azadirachtaindica*, *Dalbergia sissoo*, *F. benghalensis* and *Ficusreligiosa* collected from Polluted sited (experimental sites) and non-polluted sites of Kurukshetra district, Haryana.

Preparation of Plant extract

Through the process of cold maceration, leaf extract from selected plants was produced. To remove any dust and foreign material, the leaves were thoroughly rinsed with water. The samples were shed dried for seven days. The finely powdered prepared by using a grinder after drying. Amber-colored bottles were used to keep this powder sample. These ground samples were extracted by immersion in Methanol and water in a proportion of 200 ml of solvent to 20 grams powder sample. For 24 hours, the solution was incubated in an incubator with a shaker. After the material was extracted, Whatman filter paper was used to filter it. The produced solution was allowed to dry for seven days in order to get a semi-solid consistency. Then, these extracts were diluted in DMSO to produce a concentration of 1 mg/ 1 ml.The dissolved extract was kept at 4^0Celsius until it was examined (Kalita Chandana et al 2018; DoddannaSunithaJagalun et al 2013; Sitara, U. and N. Hasan, 2013; Challa, Krishna, 2013)

Microorganisms

For the present study *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *A. niger* were used for the evaluation of antimicrobial activity of polluted and non-polluted sites of Kurukshetra district, Haryana., India.

Determination of antimicrobial activity

By using the disc diffusion method, the methanol and aqueous extractions of particular plants were tested against dangerous bacterial cultures of *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *A. niger*. Strains were swabbed on the surface of the Nutrient agar plates (For *A.niger*, Sabouraud Dextrose Agar (SDA) was used) and discs (Whatman No.1 filter paper with 9 mm diameter) impregnated with the 50 µl of each extract were placed on the surface separately. To compare the anti-bacterial activities, Ampicilin (20 µg/disc) used as standard antibiotic and negative control, a blank disc impregnated with solvent was used. The plates (triplicates) were incubated at 28°C for 72 hrs. The antimicrobial potency of the test samples was measured by determining the diameter of the zones of inhibition in millimetre.

Results and Discussion

The leaf methanolic and aqueous extract of *Polyalthialongifolia, Azadirachtaindica, Dalbergia sissoo,Ficus benghalensis*and *Ficusreligiosa* have been screened for their antimicrobial activity and very interesting profiles have been found against *P.aeruginosa, Staphylococcus aureus* , *Escherichia coli* and *A.niger* microbial strains. The 50ul concentration of aqueous and methanolic concentration was studied and compared with standard antibiotic ampicillin. Their Zone of inhibition (ZOI) can be seen at a glance as follows **table -1**.

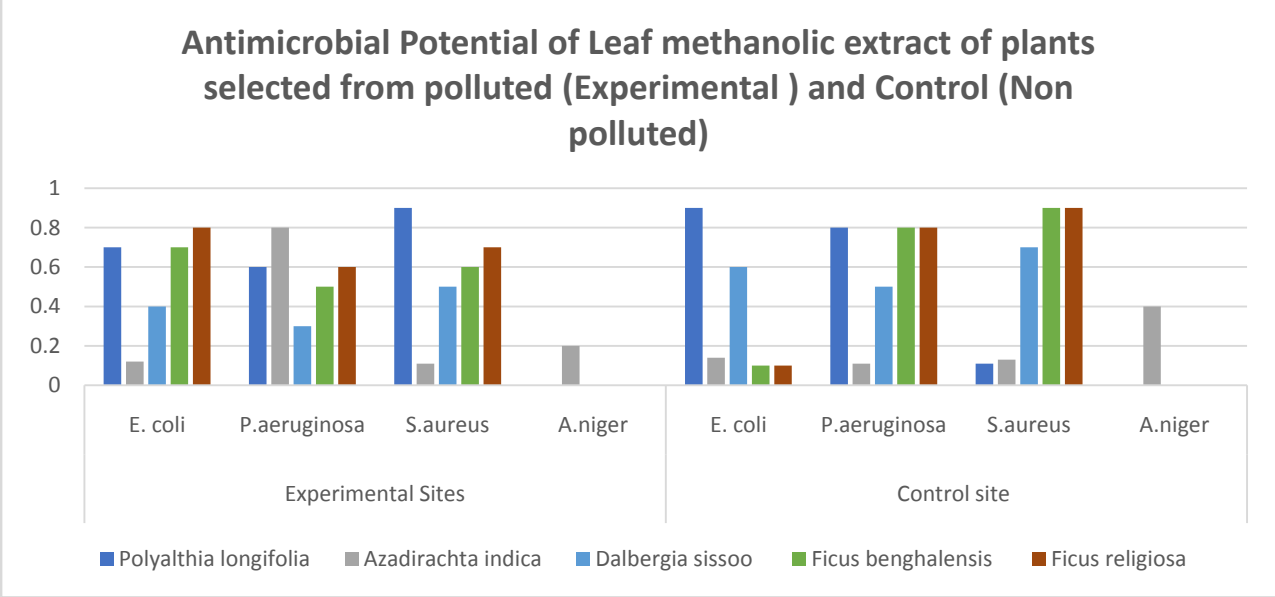
The concentrations (50ul) of the Methanol extract of *Azadirachtaindica* on non-polluted site showed highest activity against all four microbial strains. Though, the highest activity observed was against *Staphylococcus aureus* having diameter of Zone of inhibition (DIZ) 11mm and *A.niger*having 20mm DIZ but, the activity of standard drug ampicillin observed was 40 mm DIZ against *Staphylococcus aureus* which can be practically considered as highest. The remaining plant extract of polluted and non-polluted sites showed nil activity against selected microbial strains. The methanolic leaf extract of *Polyalthialongifolia, Dalbergiasissoo, Ficus benghalensis*and *Ficusreligiosa* of polluted and non-polluted sites showed sustained activity against all three bacterial strains. The *Dalbergia sissoo* leafmethanolic extract showed minimum DIZ in all selected plants of polluted and non-polluted sites. Moreover, activity was quite reasonable and high in methanolic leaf extract of plants collected from non-polluted against three bacteria strains. In contrast, Methanolic extract showed maximum inhibition against all micro-organism which can be directly observed in **Table -1**.

In present study, it is also observed that that leaf methanol extracts of selected plant species (*Polyalthialongifolia, Azadirachtaindica, Dalbergia sissoo, Ficus benghalensis* and *Ficusreligiosa*) growing in polluted site will show higher bioactivity against microbes compared to those from non-polluted site. However, Leaf extract of *Azadirachtaindica* was found most potent extract against microbes in both conditions. The result was different form the earlier study of Qasim et al., (2019) and Chan,M.W.H., et al., (2021) which reports that unfavourable conditions can induce secondary metabolite production in plants to higher levels than in plants growing in pristine or less polluted habitats. The results of presents study was supported by Fennell et al., 2004; Padmakumar, 1988; Vlachos et al., 1996.

Table -1:Determination of Antimicrobial potential of Plants growing in Polluted and non-polluted sites

S.no	Plant Species	Experimental Sites				Control site			
		E. coli	*P. Aeruginosa*	*S. Aureus*	*A. niger*	*E. coli*	*P. aeruginosa*	*S. aureus*	*A. niger*
1	*Polyalthialongifolia*	0.7	0.6	0.9	Nil	0.9	0.8	0.11	Nil
2	*Azadirachta indica*	0.12	0.8	0.11	0.20	0.14	0.11	0.13	0.40
3	*Dalbergia sissoo*	0.4	0.3	0.5	Nil	0.6	0.5	0.7	Nil
4	*Ficus benghalensis*	0.7	0.5	0.6	Nil	0.10	0.8	0.9	Nil
6	*Ficus religiosa*	0.8	0.6	0.7	Nil	0.10	0.8	0.9	Nil

Figure -1:Determination of Antimicrobial potential of Plants growing in Polluted and non-polluted sites



References

1. Bartfay, W.J., E. Bartfay and J.G. Johnson. (2012). Gram-negative and gram-positive antibacterial properties of the whole plant extract of willow herb (*Epilobium angustifolium*). Biol. Res. for Nursing, 14(1): 85-89.
2. Challa, Krishna (2013). Antimicrobial activity of *Azadirachta indica* (neem) leaf, bark and seed extracts. International journal of research and phytochemistry and pharmacology. 3: 1-4.
3. Chan, M. W. H., Akram, J., Gulzar, S., Zafar, U., Aslam, S., Siddiqui, P. J. A., ... & Rasheed, M.(2021). Comparative study on antimicrobial activities of mangroves growing in polluted and non-polluted sites of northern arabian sea. Pak. J. Bot, 53(2), 723-729.
4. DoddannaSunithaJagalur, Patel Shilpa, SundarraoMadhusudanAstekar, VeerabhadrappaRavindraSetru (2013). Antimicrobial activity of plant extracts on Candida albicans: An in vitro study. Indian Journal of Dental Research. 24 (4): 401-405.
5. KalitaChandana, SaikiaAnkumoni, Sarma Ajanta, SaikiaKasturi, SaikiaAnjanamoyee, SaikiaAnjan Kumar (2018) Antibacterial and antifungal property of three plants against oral microbes. Journal of Mahatma Gandhi Institute of Medical Sciences. 23(2): 73-7 91
6. Muhammad, M.T., N. Fayyaz, S. Tauseef, U. Razaq, M.A. Versiani, A. Ahmad, S. Faizi and M. Rasheed. (2015). Antibacterial activity of flower of *Melia azedarach* Linn. and identification of its metabolites. J. Kor. Soc. Appl. Biol. Chem., 58(2): 219-227.
7. Nadir, M., M. Rasheed, S.K. Sherwani, S.U. Kazmi and V.U. Ahmad. (2013). Chemical and antimicrobial studies on the essential oil from *Salvia santolinifolia*Boiss. Pak. J. Pharm. Sci., 26(1): 39-52.
8. Navami, S.S. and D.S. Jaya. (2013). Assessment of pollution stress on the physio-biochemical characteristics of mangrove species in Akkulam-Veli Lake, South India. Global J. Environ. Res., 7(2): 26-33.
9. Qasim, M., Y. Fujii, M.Z. Ahmed, I. Aziz, K.N. Watanabe and M.A. Khan. (2019). Phytotoxic analysis of coastal medicinal plants and quantification of phenolic compounds using HPLC. Plant Biosys., 11: 1-8. https://doi.org/10.1080/11263504.2018.1549607

10. Qasim, M., Z. Abideen, M. Adnan, S. Gulzar, B. Gul, M. Rasheed and M.A. Khan. (2017). Antioxidant properties phenolic composition bioactive compounds and nutritive value of medicinal halophytes commonly used as herbal teas. S. Afr. J. Bot., 110: 240-250
11. Rezanejad, F. (2009). Air pollution effects on structure, proteins and flavonoids in pollen grains of *Thujaorientalis* L. (Cupressaceae). Grana., 3: 205-213
12. Rhodes, M.J. (1994). Physiological roles for secondary metabolites in plants: some progress, many outstanding problems. Plant Mol. Biol., 24(1): 1-20.
13. Schippmann, U., D.J. Leaman and A.B. Cunningham. (2002). Impact of cultivation and gathering of medicinal plants on biodiversity: global trends and issues. Biodiversity and the Ecosystem Approach in Agriculture, Forestry and Fisheries: Satellite Event on the Occasion of the Ninth Regular Session of the Commission on Genetic Resource for Food and Agriculture. FAO, Rome. p. 1-21]
14. Sitara, U. and N. Hasan (2011). Studies on the efficacy of chemical and non-chemical treatments to control mycoflora associated with chilli seed. Pak. J. Bot. 43: 95-110.