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# Antibacterial Activity of *Amaranthus Viridis*

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**ABSTRACT**
*Resistance in microbes against antibiotics is a worldwide problem that is caused because of frequent exposure of antibiotics. There are millions of chemical compounds that are being synthesized, thousands of which have been confirmed for their antimicrobial potential. A. viridis leaves and stem extracts in different solvents chloroform, ethanol and methanol were investigated for their antibacterial potentiality against Gram-positive (Staphylococcus aureus) and Gram -negative (E.coli and K.pneumoniae etc) bacteria. Comparative analysis by ANOVA exhibited that a significant ($p<0.05$) variation exists between the antimicrobial activities of stem and leaves extracts of all solvents. Based on results supported by different studies, it was found that the ethanol extract of stem and leaves show greater antimicrobial activity than methanol and chloroform. In most studies disk diffusion assay was used to determine the antibacterial activity. This trial showed that the plant extracts have potential against pathogenic bacteria.*
*Keywords: Antibacterial Activity, Amaranthus Viridis*

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## INTRODUCTION

Plants are necessary in our lives because they fulfill our necessities regarding food, clothing, shelter, ornamentals, flavoring and medicine. Many Plant species have been tested for their antimicrobial potential in the past 20 years [1.

In developing countries the human died due to common infectious microbial diseases [2]. Plants are rich in secondary metabolites such as tannins terpenoids, alkaloids and flavonoids. Medicinal plants may offer a new source of antibacterial, antifungal and antiviral activities [3].

Many studies have been undertaken to determine the different antimicrobial and phytochemical components of the medicinal plants [4].

Plants have natural potential to synthesize secondary metabolites related to defense mechanism which have ability to eradicate microbial life such as pathogenic bacteria [5].(Barbosa, 2004). In these plants In these plants there are important oils that are being secreted from different parts of plants have potential against pathogenic microorganisms [6]. These herbal plants are being studied in medical research [7]. Various studies have suggested that they possess bioactive components. Due to physiological and clinical achievement there are better results and are effectively important [8]. These antimicrobial agents can be used to treat many diseases [9].

## *AMARATHUS VIRIDIS*

*A.viridis* is found in Pakistan, Bangladesh and south India where it has been used as vegetable [10]. *Amaranthus viridis* is also been used as a medicinal herb [11]. This plant is preferable for antibacterial activity because it can resist to drought and hot climatic conditions [12]. Oxidation of different compounds produces reactive oxygen species which have ability to cause different diseases such as cancer [13].

**Fig1: Morphology of *A. viridis***

**ANTIMICROBIAL ACTIVITY MECHANISMS OF NATURAL PRODUCTS**

Active compounds of the herbal plants such as terpenes and carvacrol can affect significantly different sites of bacteria to eradicate bacterial infection. Many compounds can damage plasma membrane and cytoplasm of the bacterial cell and can also affect protein of the Bacteria.

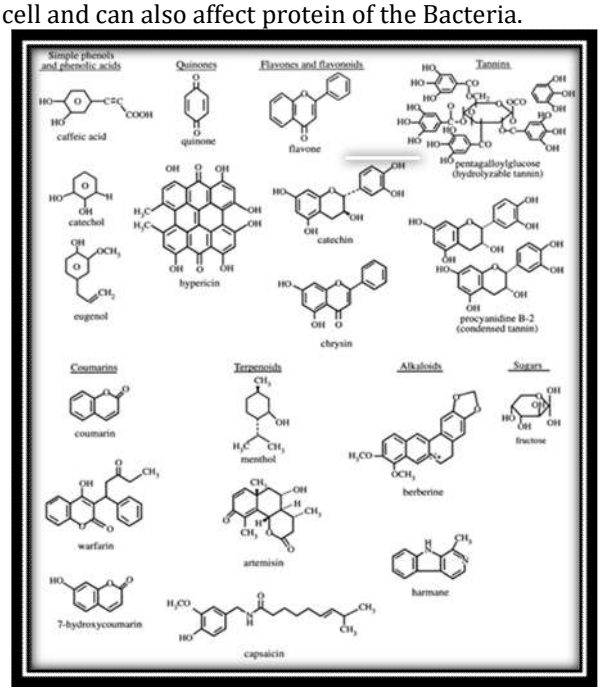


**Fig 2: NATURAL PRODUCTS FOUND IN *A. VIRIDIS* [14]**

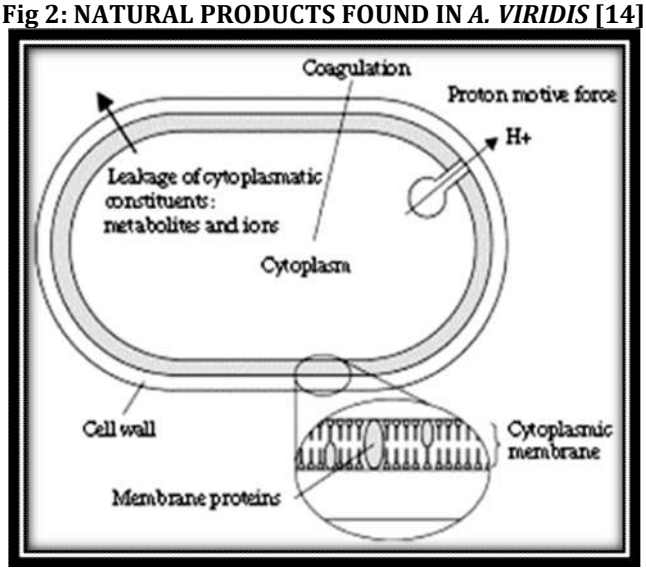


**Fig 3: SITE IN BACTERIA WHERE NATURAL COMPOUNDS ARE ACTIVE [15]**

Important characteristics responsible for the antimicrobial action of essential oils include hydrophobic components that allow the participation of lipids from the bacterial cell membrane, which disturbs cell structures and make them more permeable [15].

## ANTIBACTERIAL ACTIVITY OF *A. viridis*

## MATERIALS AND METHODS

Medicinal plants including *A. viridis* have been checked for their antibacterial potential against clinically important as well as pathogenic bacteria population. In most studies disk diffusion method was used to determine antibacterial activities.

The extraction has been carried out by Soxhlet extraction method. Dry powder of plant material is weighed using an analytical balance and is extracted with different solvents (methanol, ethanol, and chloroform) using soxhlet extractor and it has been condensed under low pressure in rotary flash evaporator to serve as mother extract. Soxhlet apparatus was used for extraction. The advantage of this extraction is that only clean warm solvent is used to extract the solid in thimble and also that instead many portions of the warm solvent passed through the sample, just one batch of the sample is recycled. This increases the efficiency of the extraction when compared with simply heating up the solid in a flask with the solvent.Soxhlet extractor has five main components. These components are condenser, extraction chamber, thimble, siphon arm, and round boiling flask. Each sample was processed at least 2-6 hours for the maximum extraction. The ground powder was taken inside the thimble, prepared by the filter paper and placed in the main chamber of the soxhlet extractor. Solvent was filled in the flask of extractor, kept on the heating mantle. The solvent was heated to reflux. The solvent vapors moved in the distillation arm, condensed back to pass through the sample, dissolve the solid along with it. After the completion of 2-6 cycles, solvent mixture was collected from the siphon arm. The solvent mixtures were then evaporated through rotary evaporator.

## RESULTA AND DISCUSSION

In various studies it has found that *A. viridis* leaves and stem extracts in different solvents chloroform, ethanol and methanol were investigated for their antibacterial potentiality against Gram-positive (*Staphylococcus aureus*) and Gram-negative (*E.coli*and *K. pneumoniae)* bacteria. Comparative analysis by ANOVA exhibited that a significant ($p<0.05$) variation exists between the antimicrobial activities of stem and leaves extracts of all solvents. Based on the results of these findings, it was found that the ethanol extract of stem and leaves show greater antimicrobial activity than methanol and chloroform.

Ethanol leaves extract as compared to other solvent extracts has a significant of difference inhibition activities against all three strains. These results are supported by where ten ethanol and aqueous plant extracts were assayed for the effect against multi-drug resistant *S. aureus.* Ethanolic extracts of all the plants showed considerable antibacterial activity against *S. aureus*. Maximum activity of ethanolic extract was shown in different plants*.* All plants showed greater inhibitory activity in the ethanolic when compared to aqueous extract, with the exception of the aqueous extract of *M. elengi.*

The methanol extracts showed considerable antimicrobial activity. Results were reported by Altaf *et al*., [16]. In his study, Samples of medicinal plants were extracted using water and methanol and tested for their antimicrobial activities against pathogenic stains and usual strains of wound causing bacteria by disc diffusion method. Methanol extracts had comparatively more activities as compared to their corresponding aqueous extracts. Polarity of methanol and high stability of plant secondary metabolite in methanol could be probable reason for high extractive value.

Chloroform extracts of *A. viridis* were found to show lesser inhibition than methanol and ethanol. This was supported by statistical analysis for both stem and leaves. This finding was reported by Islam *et al*., [17]. Their results were higher in methanol as compared to chloroform as extractive solvent.

Maximum zone of inhibition was showed by when methanolic extract of leaves was applied. These findings are supported by Maiyo *et al*, [18] in their study, they extracted more than ten medicinal plants in different solvents (ethanol, methanol) and determined their antimicrobial activity using disc diffusion method and agar well diffusion method against *Staphylococcus spp., E.coli, Pseudomonas spp., and Klebsiella spp.* Methanolic extracts exhibited maximum antibacterial activity against *K. pneumoniae*

Leaves extracts of *A. viridis* showed approximately equal zone of inhibition against *S. aureus* and *E.coli*. These results were found by Mahesh and Satish [19]. They determined antibacterial activity of medicinal plants against plant and human pathogens. Leaves extracts of this herbal pant were found to show similar antimicrobial activity against *E.coli* and *S. aureus* measuring 15 mm zone of inhibition for both strains.

Statistical results in one reported study revealed that both stem and leaves of *A. virids* showed a significant inhibitory activity against test strains. In case of *E. coli* and *S. aureus*, the leaves extract of *A. viridis* showed greater anti- microbial activity than stem extract [20, 21]. They worked on antibacterial

activities of some herbal products used in Pakistan. The antibacterial activities of different plants exhibited greater antimicrobial activity against *E. coli* than *P. auriginosa.*

In another reported study it was proposed that *E.coli* was found to be most sensitive strain against *A. viridis* extract. Antibacterial activity was inspected against three herbal products and ten medicinal plants. Methanolic extracts of each Gram positive and Gram negative bacteria. In all extracted plant solvents, methanolic extracts exhibited maximum activities. It is theorized that the gram positive bacteria are more susceptible than gram negative bacteria due to their difference in their cell wall structure. Gram negative organisms are considered to be more resistant due to their outer membrane acting as a barrier to many environmental substances, including antibiotics. However the results from study reveal that the crude extracts of medicinal plants contains certain constituents with significant antibacterial activity.*A. virids* has some important medicinally imported constitutes. Methanol extracts of the dried leaves and seeds of *Amaranthus viridis* were collected and used for phytochemicals and antibacterial analysis. By detecting the MIC and zone inhibition, the antibacterial activity was determined against different bacterial and fungal strains. The extract yields from the leaves and seeds ranged 5.5 - 6.1 and 2.42% - 3.72% w/w, respectively. Phytochemical investigation of this plant determines that tanins (6.07% - 5.96%), saponins (53% - 32%), alkaloids (13.14% - 11.42%), protiens (16.76% - 24.51%) and glycosides (63.2% - 32.3%) were rich in leaves. The extracts also contained appreciable levels of total phenolic contents (2.81 - 3.61 GAE, g/100 g), total flavanoid contents (18.4 - 5.42 QE, g/100 g) and DPPH free radical scavenging activity, showing $IC_{50}$ (83.45 - 75.95 µg/mL) along with reducing power was calculated. The MIC of extracts ranged 178 - 645 µg/mL. The results of this study suggest the possibility of using the methanolic extracts in treating the diseases caused by the test organisms [23].

In another study the results from MIC indicated that *E. coli* was most sensitive microbe tested, showing the largest inhibition zones (24 mm) for leaves and minimum (18 mm) for seeds extracts. The least activity is inhibited by 80% methanol seeds extract against *R. oligosporus*, with the smallest zone (13 mm). In general, the antimicrobial activity of the tested *A. viridis* leaves and seeds extracts was comparable with the standard drugs, streptomycin and mecanozol. In support to our present data, in a previous study, isolation of the antifungal peptide from the *A. viridis* seed extracts has been done [24].

## INTERACTION BETWEEN NATURAL PRODUCTS AND ANTIMICROBIAL DRUGS

In addition to the antimicrobial action of plant extracts and essential oils, a synergism between conventional antimicrobial drugs and products obtained from medicinal plants has also been reported. Possible interactions among medications are frequently observed, which has motivated researchers to test such possibilities because the antibacterial activity would enhance by applying synergistic effects. However, it must be emphasized that interactions between synthetic and natural drugs depend on several factors including pharmacokinetics and employed doses, since combinations confirmed *in vitro* may not have the same effect on humans.

## FINAL REMARKS

Since ancient times, plants have been used by several communities to treat a large number of diseases, including infections. Numerous studies on the pharmacology of medicinal plants have been accomplished, since they constitute a potential source for the production of new medicines and may enhance the effects of conventional antimicrobials, which will probably decrease costs and improve the treatment quality. However, several plants may present antagonistic effects during antibiotic therapy.

An important aspect comprises the search for new compounds that have antimicrobial action and synergism with currently available antimicrobial drugs, since bacteria resistant to conventional medicines are increasingly frequent; consequently, medicinal plants constitute an alternative for infection treatment.

The antimicrobial activity of plants was proven by various examples, in the form of both essential oils and extracts. Thus, this property can be a promising ally in the development of medicines necessary to combat the increasing number of bacterial strains that become resistant to conventional antibiotics.

Therefore, given that the literature on tests for the antimicrobial action of plant products is broad, including an increasing number of publications per year, it is highly difficult to relate the countless reports on the antimicrobial action of these products in this review article about a subject of such a great complexity, which requires a multidisciplinary approach.

## REFERENCES

1. Castello, M. C., Anita, P., naresh, C. and Madhuri, S. (2002). "Antimicrobial Activity of Crude Extracts from Plant Parts and Corresponding Calli of Bixaorellina. Ind," *Journal of Experimental Biotechnology,* **40**: 1378-1381.
2. Nethane, C. (2004). Antibiotics at the crossroads. *Nature,* **431:** 899-902.

3. Willcox, J. K., Ash, S. L. and Catignani, G .L. (2004). "Antioxidants and Prevention of Chronic Diseases," *Critical Reviews in Food Science and nutrition,* **44**(4): 275-295.
4. Akinpelu, D. A. and Onakoya, T.M. (2006). An antimicrobial activity of medicinal plants used in folklore remedies in south-western Africa. *Journal of Afican tradition,***3**: 112-115.
5. Barbosa, L. C. A. (2004). Pesticides, the man and the environment.*Journel of Medical Biotechnology*Vicosa,**5**: 215.
6. Batish, D. R., Lavanya, K., Singh, H. P. and Kohli, R. K. 2007. Phenolic allelochemicals released by *Chenopodium murale* effect the growth, nodulation and macromolecule content in chickpea and pea. *Plant Growth Regulation,* **51**: 119-128.
7. Sinclair, S. (1998). Chinese herbs: a clinical review of *Astragalus, Liguisticum*and*Schizandrae*. *Altern.Med. Rev.* **3**: 338-344.
8. Merken, H. M., Merken, C. D. and Beecher, G. R (2001).Kinetics method for the quantitation of athocyanidins, flavonols and flavones in food.*J.Agricult Food chem.***49**: 2727-2732.
9. Holm, G., Herbst, V. B. 2001.Brogenkunde. IN: *PlantaMedica,* **67:**263-269.
10. Kruti, P., Solanki, B., Maniar, K., Gurav, N. and Bhatt, S. (2011). Natural herbal supplements an assessment of their nutritional value and their plytochemical constituents. *International Journal of Pharmacology and Biological Sciences,* **2**:420-431.
11. Amin, I., Norazaidah, Y. and Hainida, E. (2006).Antioxidant activity and phenolic content of blanched *Amaranthus species.Journal of food Chemistry,* **94**: 47-52.
12. Saxena, R., Venkaiah, K., Anitha, P., Venu, L. and Raghunath, M. 2007. Antioxidant activity of commonly used plant foods of India: Contribution of their phenolic content. Int. *J. Food. Sci. Nutr.,* **58:** 250-260.
13. Willcox, J. K., Ash, S. L. and Catignani, G .L. (2004). "Antioxidants and Prevention of Chronic Diseases," *Critical Reviews in Food Science and nutrition,* **44**(4): 275-295.
14. Ng, T. B., F. Liu, and Z. T. Wang (2000). "Antioxidative activity of natural products from plants." *Life sciences* **66**: 709-723.
15. Keyes K, Lee MD, Maurer JJ.(2003). Antibiotics: Mode of Action, Mechanisms of Resistance and Transfer. Microbial Food Safetry in Animal Agriculture Current Topics. ME Torrence and RE Isaacson, eds. Iowa State Press, Ames, Iowa, USA.
16. Altaf, M. Hussain, RehmanKokab and Qayum M, Khan. (2013). Antimicrobial activity of some medicinal Plants of Nakyal district Kotli and Azad Kashmir. *International Journal of Agriculture* and *Food Research*.**2**:1-8.
17. Islam, M. Ali, Ejaz. Jamshaid, M. and Khan Javid. 2010. Antimicrobial and irritant activity of the extracts of *Amarnthusviridis*. *Pak. J. Phrma,* **1:** 20-23.
18. Mahesh, B. and Satish, S. (2008). Antimicrobial activity of some important medicinal plants against plant and human pathogens. *World j. Agric. Sci*, **4:** 839-843.
19. Maiyo, Z. C., Nagure, R, M. Matasyoh, J. C. and Chepkorir. (2009). Phtochemical constituents and antimicrobial activity of leaf extracts of three Amaranthus plant species. *African j of Biotech*, **9:** 3178-3182.
20. Iqbal J. M, Haif. Sumaira, MahmoodZahid and Jamil Amer. 2012. Antioxidant and antimicrobial activity of *Amaranthus viridis* Leaf and Seed extract. *Journal of Medicinal Plants Research*,**6:** 4450-4455.
21. Walter. Cynthia, Shinwari K. Zabta and Riffat N. Malik. 2011. Antibacterial activities in herbal products used in Pakistan. *Pak J. Bo,.***43**: 155-162.
22. Ahmed, S. A., Hanif, S., &Iftkhar, T. (2013).Phytochemical Profiling with Antioxidant and Antimicrobial Screening of *Amaranthusviridis* L. Leaf and Seed Extracts. *Open Journal of Medical Microbiology*,
23. Lipkin A, Veronika A, Aleksandra N, Aleksey B, Eberhardt K, Mikhae LB, Eugene G, Tsezi E (2004). An antimicrobial peptide Ar-AMP from amaranth (*Amaranthus retroflexus* L.) seeds. J. Sci. Direct., **34**: 93-95



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