Review Article

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ANTIBACTERIAL ACTIVITY OF ARACEAE: AN OVERVIEW

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ABSTRACT
Infectious diseases account for approximately one-half of all deaths in tropical countries. In industrialized nations, despite the progress made in the understanding of microbiology and their control, incidents of epidemics due to drug resistant microorganisms and the emergence of hitherto unknown disease-causing microbes, pose enormous public health concerns. Historically, plants have provided a good source of antiinfective agents and remain highly effective instruments in the fight against microbial infections. The Araceae is a large family comprising some hundred genera and more than fifteen hundred species. Most of the aroids prefer to grow in moist or shady habitats. Some are terrestrial while others are vines, creepers or climbers. Many species of the aroids are also epiphytes. Many plants of family Araceae have been reported to have antibacterial activities and huge number of researches are going on with the different plants of Araceae for screening of pure compounds responsible for this antibacterial activity. Present article will highlight the antibacterial activity of different plants of Araceae family.
Keywords: Araceae, infectious diseases, microorganisms, antibacterial

INTRODUCTION

An antimicrobial is a substance that kills or inhibits the growth of microorganisms such as bacteria, fungi or protozoan[1]. A wide range of natural compounds are used as antimicrobials. Traditional healers since long have been using plants to prevent or cure infectious diseases. Many of these plants have been investigated scientifically for antimicrobial activity and a large number of plant products have shown to inhibit the growth of pathogenic microorganisms. A number of these agents have different structures and modes of action that are distinct from those of the antibiotics in current use, suggesting that cross resistance with agents already in use may be minimal. Within the recent years, infectious diseases have increased to a great extent and antibiotic resistance have become an ever increasing therapeutic problem[2]. So it's a time for worldwide movements towards finding out chemical constituents from various parts of plants and the bioactivity studies of the novel drugs isolated. As significant antibacterial activities have been shown by some members of the family Araceae (from the literature survey), they need special attention by researchers for isolating their chemical backgrounds and prove their related biological applications.

The Araceae is a large family comprising about 105 genera and approximately 3000 species of herbaceous monocotyledons. These are predominantly tropical in distribution with 90% of genera and 95% of species restricted to the tropics. The family contains several well known cultivated foliage and flowering plants like *Philodendron, Monstera, Spathiphyllum*, *Anthurium*, etc. A number of food crops also belong to Araceae, notably *Xanthosoma, Colocasia*, *Amorphophallus,* etc. One of the important character of the family is the inflorescence structure; small flowers born on fleshy axis (spadix) subtended by a modified leaf (spathe)[3]. Majority of the members of Araceae also contain crystals of calcium oxalate which are often cited as causing intense irritation when handling or consuming raw. However, this supposition is contradicted by the fact that although irritation generally is not produced by properly cooked plants. Other compound must therefore be involved with causing this reaction. Studies on *Dieffenbachia* demonstrated that a proteolytic enzyme and other compounds are responsible for the severe irritation caused by this plant and the raphides of calcium oxalate do not play major role[4]. Literature survey reveals that many plants of the family Araceae possess significant antibacterial activities and the antibacterial activities of some of these plants will be highlighted in the present paper.

Antibacterial Activity

Bacteria are prokaryotic microorganisms found in all types of habitats wherever organic matter is present. Some of the bacteria shows pleomorphic phenomenon also. A large number of bacteria are known to cause diseases in plants and animals including human. Pathogenic bacteria harm the host by either direct attacking on host cells or by releasing toxins which are of two types- exotoxins and endotoxins[5].

The members of Araceae possessing antibacterial activities are briefly discussed below -

The hexane extract of leaves of *Syngonium podophyllum* showed moderate activities against *E.coli* and *Pseudomonas* but there was no zone of inhibition in *Staphylococcus* and *Enterococcus faecalis*[6].

Table 1: List of some plants of Araceae showing strong Antibacterial activity

Name of the plants	Parts used	Extract/compound	Bacterial strain with zone of inhibition in mm	References
Raphidophora pertusa	Stem	Ethanol	*Eshcherichia coli* (12.5), *B.subtilis* (13.4)	16
Anchomonas difformis	Stem Root Leaf	Water Water Water	*Klebsiella pneumoniae* (17) *Klebsiella pneumoniae* (19), *Staphylococcus aureus* (19) *Klebsiella pneumoniae* (18), *Staphylococcus aureus* (18)	17
Amorphohallus commutatus	Tuber	Benzene Ethylacetate	*Pseudomonas* (19), *Salmonella typhi* (17) *E.coli* (10)	18
Epipremnum aureum	Leaves Root	Ethanol Water Methanol Acetone	*E.coli* (16), *Micrococcus luteus (*14), *Bacillus subtilis* (20), *B.cereus* (13) *E.coli* (24), *M.luteus* (17) *B.subtilis* (21) *B.cereus* (18)	19
Alocasia indica	Leaves	Ethanol	*E.coli* (19), *Klebsiella pneumoniae* (17), *Staphylococcus aureus (*16), *Bacillus subtilis* (22)	20
Typhonium trilobatum	Tuber	Ethanol	*Proteus mirabilis* (15), *Staphylococcus aureus* (32) *Proteus mirabilis* (18), *Salmonella typhi* (18)	21
Pothos aurea on *Areca catechu*	Aerial roots	Petroleum ether Acetone Ethanol	*Staphylococcus aureus* (15) *E.coli* (15) *E.coli* (15)	22
Pothos aurea on *Lawsonia intermis*	Aerial roots	Acetone	*Staphylococcus aureus* (15)	22
Dieffenbachia picta	Leaf Stem	Essential oil Essential oil	*Pseudomonas aeruginosa* (20), *Staphylococcus aureus* (20), *E.coli* (18), *Salmonella typhi* (18) *Staphylococcus aureus* (22), *E.coli* (18), *Pseudomonas aeruginosa* 18), *Salmonella typhi* (18)	23
Colocasia esculenta	Leaves	Water	*Vibrio harveyi* (12), *V.cholerae* (11)	24
Colocasia esculenta	Leaves	Chloroform Methanol	*E.coli* (19) *Bacillus subtilis* (20), *Staphylococcus aureus* (20)	25
Lagendra ovata	Rhizome	Fraction 7 from methanol extract column Fraction 8 from same extract	*Eshcherichia coli* (28), *Staphylococcus aureus* (20) *Eshcherichia coli* (26), *Staphylococcus aureus* (22)	26
Scindapsus officinales	Fruit	Water Ethanol	*Salmonella typhi* (7.5) *Salmonella typhi* (9), *Eshcherichia coli* (9.5)	27

Acorus calamus is an indigenous plant of Araceae. Studies on chemical investigation of *A. calamus* revealed the presence of compound like alpha and beta asarone, safrol, iso asarone, caryophyllene, methyl isoeugenol in rhizome and roots[7]. The essential oil of *A. calamus* showed positive results as antibacterial activity agent against *Bacillus subtilis, B. pumilus*, *Cornybacterium diptheriae, Pseudomonas solacearum, Salmonella typhosa, Sarcina lutea, Shigella diphtheria, Staphylococcus aureus, S. albus, Streptococcus faecalis, S. pyrogenes and Vibrio cholerae.* The dried rhizome of *A. calamus* also showed antibacterial activity against *Bacillus proteus, Hemophilus pertusis, Shigella dysenteriae, Streptococcus pneumoniae*[8]. The compound beta asarone obtained from the column chromatography of methanol extract of rhizome of *A.calamus* showed zone of inhibition against methicilin resisitant *Staphylococcus aureus* MRSA and *Staphylococcus aureus* ATCC25923[9]. The ethyl acetate extract of leaf and rhizome of *A. calamus* showed strong antibacterial activity against *Eshcherichia coli* MTCC901 and *E.coli* NCIM[7]. The petroleum extract of rhizome of *A. calamus* also showed antibacterial activity against *Pseudomonas aeruginosa*[10].

The petroleum ether, ethyl acetate and methanolic extract of rhizome of *Lasia spinosa* L. revealed moderate activities against *E. coli, B. cereus, S. aureus, V. parahemolyticus*[11].

The methanolic stem extract of *Rhaphidophora pertusa* possess moderate antibacterial activity against the tested gram positive bacteria (*Staphylococcus aureus & Streptococcus pyrogenes*) and gram negative bacteria (*E. coli, B. subtilis, K. pneumoniae, P. aeruginosa, S. typhi*) with MIC values ranging between 1.0-4.0 mg/ml[12].

Salviasperanol isolated from *Amorphophallus campanulatus* showed significant activity against *B. subtilis, B. aureus, B. megaterium, Streptococcus B haemolyticus, E. coli, Shigella dysenteriae, S. sonnei, S. flexnerie, P. aeruginosa, S. typhi*[13].

The ethanolic extract of of *Arisaema leschenaultia* Blume possess potent antibacterial activity against *S. aureus, B. subtilis, B. cereus, Sarcina lutea*[14].

Four hydroperoxylsterols isolated from the n-hexane extract of aerial parts of *Xanthosoma robustum* showed moderate antibacterial activities against *Eshcherichia coli, Bacillus subtilis* and *Micrococcus luteus*[15].

Besides the above mentioned plants of Araceae, some other members of Araceae also possess significant antibacterial activities which are described briefly in the tabular form. (Table 1)

CONCLUSION

Literature survey reveals that research works on antibacterial activity have been conducted on different plants of Araceae and most of the plants under investigation have shown significant activity against different pathogenic bacteria. From the available data, regarding the zone of inhibitions indicate that the bacterial strains whose activities have been inhibited most by the secondary metabolites present in the crude extracts of the plants are *Escherichia coli, Bacillus subtilis, Staphylococcus aureus, Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Maximum zone of inhibition have been observed in case of ethanol extract obtained from tuber of *Typhonium trilobatum* having 32mm zone of inhibition against *Staphylococcus aureus*. In all the papers studied, zone of inhibition of the plant extracts against bacterial inoculums have been compared with the zone of inhibition of the standard antibiotics to find out their level of significance.

As antibacterial activity screening have been performed mainly with the crude extracts of different plants of Araceae so extensive studies should be carried out on isolation and characterization of pure chemical constituents from those plants for their successful clinical application in curing various diseases. Attention should also be paid by the researchers to carry out research with other plants of Araceae which may enrich the area of medicinal chemistry by providing valuable drugs with better efficacy.

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