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Analysis of Phytochemical Profile and Evaluation of Pharmacological Effects of Alocasia Macrorrhizos

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ABSTRACT

Medicinal plants continue to serve as valuable sources of therapeutic agents due to their diverse bioactive constituents. The present study investigated the phytochemical profile and pharmacological effects of Alocasia macrorrhizos (giant taro), a plant traditionally used in ethnomedicine. Qualitative phytochemical screening of the plant extract revealed the presence of secondary metabolites including alkaloids, flavonoids, tannins, saponins, glycosides, terpenoids, and phenolic compounds, all of which are known to contribute to various biological activities. The pharmacological evaluation was conducted through in vitro and in vivo assays to assess parameters such as antioxidant, antimicrobial, anti-inflammatory, and analgesic properties. The extract demonstrated significant dose-dependent activity when compared to standard reference drugs, indicating a strong correlation between its phytochemical constituents and observed pharmacological effects. These findings provide scientific validation for the traditional use of Alocasia macrorrhizos and suggest its potential as a source of novel bioactive compounds for drug development. Further studies on bioactive compound isolation, structural characterization, and mechanism of action are recommended to establish its therapeutic value.

Keywords :- *Alocasia macrorrhizos*,Phytochemical profile,Secondary metabolites;Pharmacological effects, Antioxidant activity,Anti-inflammatory, Analgesic, Antimicrobial,Medicinal plants.

INTRODUCTION

Herbal medicine, also known as phytomedicine or phytotherapy, is the study and use of medicinal plants as a foundation for conventional medicine. Artemisinin, an anti-malarial drug derived from Artemisia annua, a herb traditionally used in Chinese medicine to treat fever, has been transformed into modern treatments thanks to global pharmacology research [1]. [2] [3] There is little scientific evidence supporting the safety and efficacy of plants used in modern herbalism, and there are no purity or dosage guidelines. [1] [4] Herbal medicine can include fungi, bee products, minerals, shells, and animal parts. [5] Paraherbalism is the use of unprocessed plant or animal extracts for alternative or pseudoscientific purposes.

The role of herbal medicines in traditional healing

- The use of herbs in disease treatment dates back a long time. Herbs were commonly used in traditional folk healing methods all over the world. Some of these traditions are briefly described below, as are some examples of the wide range of important healing practices around the world that used herbs for this purpose.
- Traditional Chinese medicine: Traditional Chinese medicine has been used by the Chinese people since ancient times. Although animal and mineral materials have been used, botanicals are the most common source of remedies. Of the more than 12,000 items used by traditional healers, approximately 500 are commonly used (Li, 2000). Botanical products are only used after some form of processing, such as stir-frying or soaking in vinegar or wine. In clinical practice, traditional diagnosis may be followed by the prescription of a complex and frequently individualized treatment.

Traditional Chinese medicine is still widely used in China. More than half of the population uses traditional remedies on a regular basis, with rural areas having the highest use rate. There are approximately 5000 traditional remedies available in China, accounting for roughly one-fifth of the total Chinese pharmaceutical market (Li, 2000).

- **Indian traditional medicine:** Ayurveda is a nearly 5000-year-old medical system practiced primarily in India. It includes diet and herbal remedies, with a focus on the body, mind, and spirit in disease prevention and treatment (Morgan, 2002).

PLANT PROFILE

Alocasia Macrorrhizos

Alocasia macrorrhizos is a flowering plant in the arum family (Araceae) that is native to rainforests in Maritime Southeast Asia, New Guinea, and Queensland. [1] It has long been cultivated in South Asia, the Philippines, many Pacific islands, and other tropical regions. Common names include giant taro[3], giant alocasia, ‘ape, biga[4], and pia. [5] In Australia, it is known as the cunjevoi[5], which also refers to a marine animal**.**

Figure No. 1. : Plant of Alocasia macrorrhizos

Scientific Classification

Kingdom : Plantae

Order : Alismatales

Family : Araceae

Subfamily : Tracheophytes

Tribe : Angiosperms

Sub tribe : Monocots

Genus : Alocasia

Species : Alocasia macrorrhizos

Common names

Giant elephant's ear, giant alocasia, ape, biga and pia.

MATERIALS AND METHOD

Pant Material Collection and Preparation of Extract

The leaves of Alocasia Macrorrhizos were collected in Bhopal, Madhya Pradesh, India. The flower was shade dried, powdered, and sieved through 40 mesh. The powdered leaves were successively extracted via maceration with 90% ethanol as a solvent. The extracts were evaporated and dried to completely remove the solvent, yielding a paste form of the drug, which was then taken for further study.

Phytochemical Screening

Standard procedures were followed to extract Alocasia Macrorrhizos. Extracts of Alocasia Macrorrhizos were also qualitatively tested for chemical constituents. The extracts were phytochemically screened according to standard procedures [5,6].

Test for Carbohydrates by Molisch's Test

Add a few drops of alcoholic naphthol to the test solution, followed by a few drops of concentrated sulphuric acid through the sides of the test tube, forming purple to violet rings at the junction of two layers**.**

Test for Reducing Sugar by Fehling's Test

Each portion weighed approximately 0.5g and was dissolved in distilled water before being filtered. The filtrate was heated with 5ml each of Fehling's solution A and B. The formation of a red precipitate of cuprous oxide indicated the presence of reducing sugars.

Test for Protein by Xanthoprotein Test

To the 5ml of test solution, add 1ml of concentrated nitric acid and boil, yellow precipitate is formed. After cooling it, add 40% Sodium hydroxide solution orange color is formed.

Test for Terpenoids by Salkowski Test

Treat the extract with few drops of concentrated sulphuric acid, red color at lower layer indicates presence of steroids and formation of yellow colored lower layer indicates presence of triterpenoids.

Test for Alkaloids by Mayer's Reagent

Alkaloids give cream color precipitate with Mayer's reagent (Potassium mercuric iodide solution)

Test for Glycosides by Borntrager's Test

Boil the test material with 1ml sulphuric acid in a test tube for five minutes. Filter while hot. Cool the filtrate and shake with equal volume of dichlomethane or chloroform. Separate the lower layer of dichlomethane or chloroform and shake it with half of its volume of dilute ammonia. A rose pink to red color is produced in the ammonical layer.

Test for Cardiac Glycosides by Keller-Killian Test

Extract the drug with chloroform and evaporate it to dryness. Add 0.4ml of glacial acetic acid containing trace amount of ferric chloride transfer to a small test tube, add carefully 0.5ml of concentrated sulphuric acid by the side of the test tube. Acetic acid layer shows blue color.

Antibacterial Activity

Test organism used the various organisms like Staphylococcus aureus, Pseudomonas aeruginosa, Bacillus subtilis, Escherichia coli are procured from Department of pharmacy Dr. A.P.J. Abdul Kalam Univercity, College of pharmacy, Indore, Madhya Pradesh, India.

Antibacterial Assay

Leaf extracts of Alocasia Macrorrhizos were tested for antibacterial activity against a variety of gram positive and gram negative organisms. The leaf extracts of Alocasia Macrorrhizos were tested for antibacterial activity using the Agar cup-plate method. 20 mL of sterile nutrient agar medium was poured into sterile Petri dishes and allowed to solidify [7]. To ensure sterility, the Petri dishes were incubated at 370 degrees Celsius for 24 hours. The medium was mixed with the organisms using the pour plate method, which included 4ml of sterile agar broth and 1ml of culture. Bores were made in the medium with a sterile borer. Leaf extracts of Alocasia Macrorrhizos were dissolved in water to obtain different concentrations (100, 200 mg/ml) and sterilized by filtration through a Whattman filter paper no. 1, and 0.5 ml of each extraction concentration was added to the respective bores. The standard reference was 0.5 ml of Gentamycin at 40 µg/ml. All of the plates were incubated at 370 degrees Celsius for 24 hours. The presence of a clearly defined zone of inhibition of any size around the cup indicated antibacterial activity. The diameter of the zone of inhibition was measured and documented.

Anthelmintic Activity

Worm collection and Authentication:

The antihelminthic assay was carried out on healthy adult Indian earthworms, Pheritima posthuma, which have anatomical and physiological similarities to human intestinal roundworm parasites. Because of their ease of availability. Earthworms have been extensively used to test antihelmintic compounds. All of the earthworms were about the same size (6 cm). They were collected from a moist area near A.P.J. Abdul Kalam University's College of Pharmacy in Indore, Madhya Pradesh.

Anthelmintic Assay

Anthelmintic activity was assessed by exposing adult Pheritima posthuma to varying concentrations of Alocasia Macrorrhizos leaf extract. The anthelmintic activity was measured using the method of Ghosh et al. [8], with minor modifications. The ethanolic extracts of Alocasia Macrorrhizos were dissolved in a small amount of water, and the volume was adjusted. 10 ml of formulation containing two different concentrations of each extract of extracts was prepared, and six identical worms were placed in petri dishes. The standard drug and extract solutions were freshly prepared prior to the start

of the experiment. The time for paralysis was recorded when no movement could be seen except when the worms were vigorously shaken. The time it took for worms to die was recorded after they stopped moving when shaken vigorously or dipped in hot water (50°C), followed by the fading of their body colours. Albendazole (20 mg/mL) was used as a reference standard.

RESULTS AND DISCUSSION

Results

Alocasia Macrorrhizos leaf was screened for proteins, resins, steroids, tannins, glycosides, reducing sugar, carbohydrates, saponins, sterols, terpenoids, acidic compounds, cardiac glycosides, catechol, phenols, alkaloids, and flavonoids. The results of the phytochemical screening are presented in Table 1.

Table 1: Phytochemical constituent's analysis of Alocasia Macrorrhizos.

S.No.	Name of the Test	Phytochemical analysis of Alocasia Macrorrhizos
1	Test for carbohydrates Molisch test	+
2	Test for reducing sugar Fehlingh's test	+
3	Test for Protein Xanthoprotein test	+
4	Test for alkaloids Mayer's test	+
5	Test for Cardiac glycosides Keller Killian's test	+
6	Test for glycosides Borntrager's test	+
7	Test for Terpenoids Salkowski test	+

+ = Prescence, - = Absence

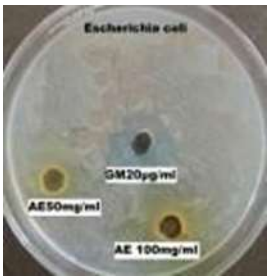
Anti-Bacterial Activity

The leaf extracts of Alocasia Macrorrhizos were tested for antibacterial activity using the standard cylinder method. Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, and Escherichia coli were the microbes used. The extract was effective against both gram- positive and gram-negative bacteria (Table 2, Figure 1). The chemical composition of Alocasia Macrorrhizos leaf extracts was found to be responsible for their antibacterial activity. The diameter of the inhibition zones was measured in millimeters [9].

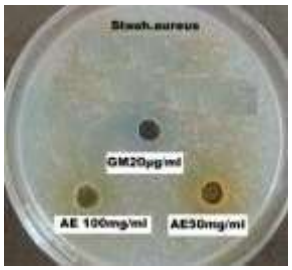
Table 2: Antibacterial activity of Alocasia Macrorrhizos leaf extract ** P< 0.01 as compared with control according to one way ANOVA.

S. No.		Zone of inhibition (in mm)			
		Ethanolic extract			
		50mg/ml	100mg/ml		
1	Bacillus subtilis ATCC11774	9±0.2887**	11±0.2887**	16±0.5774**	7±0.2887
2	Escherichia coli ATCC10536	12±0.2887**	15±0.5774**	10±0.2887**	6±0.2887
3	Staphylococcus aureus ATCCBAA1026	10±0.2887**	16±0.7077**	18±0.7077**	6±0.2887
4	Pseudomonas aeruginosa ATCC10662	9±0.2887**	10±0.2887**	12±0.2887**	6±0.2887

1. Bacillus subtilis



2. Escherichia coli



3.Staphylococcus aureus **4.Pseudomonas aeruginosa**

Figure 1: Antibacterial activity of Alocasia Macrorrhizos leaf extract.

Anthelmintic Activity

Various concentrations of Alocasia Macrorrhizos leaf extracts were tested for anthelmintic activity using an adult Indian earthworm model. The extracts demonstrated a dose-dependent inhibition of spontaneous motility (paralysis). Table 3 and Figure 2 show that ethanolic flower extracts of Alocasia Macrorrhizos caused worm paralysis and death in less time than standard Albendazole (20mg/ml). The results show that the extract has vermicidal activity and thus could be useful as an anthelmintic.

Table 3: Anthelmintic activity of Alocasia Macrorrhizos leaf extract.

Treatment group	Dose in mg/ml	Time taken for paralysis(min)	Time taken for death(min)
	100mg/ml	**9± 1.03**	**16± 2.03**
	200mg/ml	**7± 1.23**	**11± 2.09**
	10mg/ml	**9± 1.03**	**16± 1.64**
	20mg/ml	**8± 1.23**	**14± 2.09**
Control	-	-	-

All Values represent mean ± SD; n= 6 in each group; - no activity

Paralysis of the worm **Death of the worm**

Albendazole 10mg/ml

Albendazole 10mg/ml

Albendazole 20mg/ml

Albendazole 20mg/ml

100mg/ml Ethanol Extract

100mg/ml Ethanol Extract

200mg/ml Ethanol Extract

200mg/ml Ethanol Extract

Figure 2: Anthelmintic activity of Alocasia Macrorrhizos leaf extract.

SUMMARY & CONCLUSION

A preliminary phytochemical analysis revealed the presence of alkaloids, tannins, flavanoids, saponins, and other compounds. Several studies have linked the presence of these bioactive compounds in plant materials to antibacterial activity. The ethanolic leaf extract of Alocasia Macrorrhizos has demonstrated excellent antibacterial activity against gram-negative organisms when compared to gram-positive organisms, as shown in Table 2. The susceptibility pattern exhibited by the test organism to the seed extracts could be exploited for possible medicinal purposes in chemotherapy among humans, given the current spread of antibiotic resistance almost on a geometric scale [9]. The zone of inhibition for different organisms was recorded. The plant's ethanolic extract demonstrated comparable activity to the reference standard drug Gentamycin (40µg). Alocasia Macrorrhizos ethanolic extracts were found to be effective antimicrobial. Saponin's antimicrobial properties result from its ability to cause protein and enzyme leakage from the cell [10]. Helminthes are recognized as a major threat to livestock production throughout the tropics. Parasitic helminthes harm humans and animals by causing significant hardship and stunted growth. Most helminth-caused diseases are chronic and debilitating in nature [11]. Preliminary phytochemical analysis revealed the presence of alkaloids, phytosterols, tannins, flavonoids, saponins, and other constituents, which may be responsible for anthelmintic activity. Many effective drugs have their origins in traditional medicine practices, and as a result, several studies have been conducted to test natural compounds for their claimed antihelmintic activity. Many effective drugs have their origins in traditional medicine practices, and as a result, several studies have been conducted to test natural compounds for their claimed antihelmintic activity. Alocasia Macrorrhizos Ethanolic Leaf Extract has shown significant results. Table 3 shows that ethanolic leaf extract has higher anthelmintic activity than ethanol. In light of this, the findings of the current study suggest that the extract of Alocasia Macrorrhizos could be used to treat helminthic infections such as Ascariasis and hookworm infections, as the worms used in the study are similar to intestinal parasitic worms. It is critical to develop new, biologically safe, and active drugs that are both environmentally friendly and effective as antibacterial and anthelmintic agents. Medicinal plants typically contain compounds that are essential for controlling the growth of microorganisms called helminthes. Scientists have recognized the enormous potential of natural products derived from medicinal plants to serve as an alternative source of combating infections in humans, potentially at a lower cost and with less toxicity.

Conclusion

The results of antibacterial and anthelmintic activities revealed that the Alocasia Macrorrhizos flower has significant antibacterial and anthelmintic properties. Further research is required to isolate the bioactive molecules responsible for their activity, as well as to investigate and screen the compounds for other biological activities.

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