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A Review on Phytochemical Constitutions and Pharmacological activities of Acrostichum Aureum

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Abstract

The edible mangrove plant fern Acrostichum aureum is mostly found in tropical and subtropical climates worldwide. The purpose of this review was to give comprehensive information about Acrostichum aureum's traditional usage, phytochemistry, and pharmacological activities. The ethnobotany, phytochemistry, and pharmacology of the plant were thoroughly searched in scientific literature utilising databases such as Google Scholar, PubMed, Science Direct, and ResearchGate. Alkaloids, flavonoids, terpenoids, saponins, and amino acids are just a few of the phytochemicals found in Acrostichum aureum that support its wound-healing, antibacterial, anti-inflammatory, and antioxidant activities. Given its powerful therapeutic potential, more research and validation of bioactive compounds are necessary for upcoming clinical and drug-development uses.

Keywords; Acrostichum Aureum, Phytochemical Constitutions, Pharmacological Activities, Mangrove Plant Fern, Medicinal Plants.

INTRODUCTION

The incorporation of herbal remedies within the healthcare delivery framework is steadily expanding across numerous regions globally, particularly within developing nations. Many of these plants are utilised in primary health care programs, particularly for rural residents who have little access to traditional medical facilities [1]. Because there is still no proven treatment for a number of illnesses, such as cancer, diabetes, and viral infections, non-rural residents in both industrialised and developing countries have also resorted to using herbs for their medical needs [2]. Furthermore, the high cost and toxicity of traditional medications limit their use in treating many disorders. A inexpensive and alternative source of medicinal chemicals and nutraceutical supplements, mangrove plants may help control and treat both communicable and non-communicable illnesses [3]. Due to their exposure to adverse climatic and environmental circumstances, the plants create secondary metabolites and adaptive defence mechanisms that shield them from biotic and abiotic stressors. Mangrove plant species are now being tested for new chemicals that can be utilised to treat a variety of ailments due to the distinctive character of their compounds and secondary metabolites [4]. Pteridaceae families are mostly found in tropical regions, including China, Japan, Taiwan, India, Malaysia, Fiji, and Indonesia. Mangrove ferns are the only ferns that belong to the mangrove group. On the coast, mangrove ferns can thrive. "Mangroves Forrest" is another name for these mangrove plants. Swamp nails, or mangrove ferns that can survive in swamps, are another name for this region. On a modest or significant scale, mangrove ferns are bioactive; they are cytotoxic, anti-inflammatory, antioxidant, analgesic, and antiviral [5].

In traditional medicine, ferns are typically used to treat a variety of fatal illnesses, including skin conditions, wounds, coughing, and reproductive issues. They are also used to manufacture bug repellant. One such plant is Acrostichum aureum (A. aureum), one of several medicinal ferns found in Asia, including "Adiantum capillus-veneris, Cheilanthes albomarginata, and Asplenium nidus" [6]. A member of the genus Acrostichum and family Pteridaceae, "Acrostichum aureum is a mangrove fern". The sole genus of fern found in the marine intertidal zone is "Acrostichum." Globally, Acrostichum aureum is primarily found along tropical and subtropical coasts [7]. Table 1 displays the plant's taxonomical categorisation. The plant's molecular and anatomical characteristics are suited to adverse environments, such as floods, turbulence, tidal variations, excessive salinity, and long-term climatic change. The plant is gaining popularity, most likely due to its ethnomedical significance and capacity to generate phytochemicals that may help treat a variety of illnesses, including cancer, diabetes, ulcers, and viral infections [8]

Table 1: Taxonomical classification of Acrostichum aureum [8]

Kingdom	Plantae
Subkingdom	Tracheobionta
Phylum/Division	Pteridophyta
Class	Filicopsida
Order	Polypodiales
Family	Pteridaceae
Genus	Acrostichum
Species	Aureum
Common names	Golden leather Fern, paku laut, mangrove fern, coarse swamp fern, golden leather fern, piairaya, larat, pia

Figure 1: Leaves (A) and Roots (B) of Acrostichum aureum [3]

A. Morphology

The "golden leather fern, or Acrostichum aureum", is a huge understory fern found in marshes and mangrove forests. Plants are as wide as they are tall, with a height of around 1.2 to 1.8 meters (4 to 6 feet). Fronds are more erect close to the centre of the plant, although they often arch at the edges. The enormous, complex, thick, leathery leaves are between 12 and 50 cm (4.8 and 19.7 inches) wide and more than 1 m (3.3 feet) long. The alternating leaflets (pinnae) are non-overlapping, rounded at the ends, and come in 24–30 pairs. They are around 10–34 cm (3.9–13.3 inches) long and 1.3–7 cm (0.5–2.8 inches) wide. The underside of the leaf is lighter than the glossy, usually dark green, upper surface. The edges of leaves seem rather wavy and uneven. Unlike other ferns, this one does not have sori. Instead, the reproductive pinnae (the furthest five or more pairs) have sporangia spread across their underside, giving the leaves a felt-like feel. Brick-red to rust-red sporangia with spores that range in diameter from 37 to 72 and 181 m [9].

B. Ethnomedical Information of Acrostichum Aureum

In Malaysia, wounds, non-healing ulcers, and boils are treated with powdered or crushed Acrostichum aureum rhizomes. The frond is used as an antidote for venomous snakebite in India. Others have long utilised the roots and fertile fronds to treat syphilitic sores. Elephantiasis, chest aches, sore throats, purgatives, and febrifuges were all treated with Acrostichum aureum in Fiji. In Bangladesh, women with hazy urine are treated with Acrostichum aureum leaves. The leaves of this plant are used to stop bleeding in Malaysia. Table 2 lists the various Acrostichum aureum sections along with ethnomedical information [9].

Table 2: Ethnomedical information of Acrostichum aureum

Country	Part used	Uses
Malaysia	Rhizomes	wounds, non healing ulcers and boils
	Fertile fronds and roots	Syphilitic ulcers
Fiji	Plant	Sore throat, chest pains, elephantiasis, purgative and febrifuge
Bangladesh	Leaves	Cure cloudy urine in women
Malaysia	Leaves	Stop bleeding
India	leaves and roots/rhizomes	Snakebites, wounds, and certain chronic ailments

C. Pharmacological Activities of Acrostichum Aureum

Table 3 lists the various Acrostichum aureum components along with pharmacological details.

1. Anti-inflammatory activity of Acrostichum aureum

Acrostichum aureum ethanol (95%) extract's anti-inflammatory properties were investigated using several rat models of carrageenan-induced inflammation. The results showed a highly significant maximal inhibition in the carrageenan-induced oedema test in rats, with a reduction in paw volume of 65.90% ($P<0.01$) after 24 hours, which was equivalent to the reduction caused by the standard medication Indomethacin (66.66%) [10].

2. Antioxidant activity of Acrostichum aureum

Antioxidants are substances that keep both living and non-living things from oxidising. They can decrease reactive oxygen species, reactive nitrogen species, or metals in their oxidised forms by donating hydrogen. Additionally, antioxidants can stop the chain events caused by free radicals in living things. They are essential in the creation of medicinal formulations that combat a variety of illnesses because of their reducing and antiradical qualities [11].

Numerous publications have reported the antioxidant capabilities of various Acrostichum aureum extracts utilising various antioxidant tests. With an EC50 of 103.0 µg/ml, the plant's methanol twig extract demonstrated "2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity", but the IC50 for lipid peroxidant inhibition was found to be 28.99 µg/ml [3].

Acrostichum aureum ethanol extract has strong antioxidant activity in vitro. Through the use of entirely distinct measures, such as the "2, 2-diphenyl-1-picrylhydrazyl (DPPH) test, superoxide scavenging impact, reducing power, and in-vitro lipid peroxidation, this study concentrated on invitro inhibitor action". Acrostichum aureum ethanol extract was shown to be considerably efficient in scavenging DPPH (EC50 = 41.95µg/ml), according to the results [10].

3. Analgesic activity of Acrostichum aureum

The plant Acrostichum aureum's analgesic properties were discussed. Many characteristics were calculated, including writhing number and tail flick latency (TFL). Acrostichum aureum samples demonstrated a dose-dependent writhing inhibition of 28.86% ($P<0.001$) and 46.77% ($P<0.01$) at 250 and 500 mg/kg body weight, respectively. This was very similar to the standard diclofenac sodium, which showed 69.15% ($P<0.001$) at a dose of 25 mg/kg body weight [9].

Mice were used to test the ethanol leaf extract of A. aureum's analgesic properties against acetic-induced writhing. According to the findings, writhing inhibition was 28.86% and 46.77%, respectively, at 250 and 500 mg/kg body weight of A. aureum. Lower yet equivalent to the 69.15% analgesic efficacy of the usual medication, diclofenac sodium at 25 mg/kg body weight [3].

4. Anti-fertility activity of Acrostichum aureum

The ethanol and acetone extracts of Acrostichum aureum demonstrated significant anti-implantation activity in rodents, as evidenced by the results. It was shown that giving female rats the water-soluble portion of ethanolic (95%) extract on days 1–7 postcoitus inhibited conception. Both oestrogenic and anti-oestrogenic activities are absent from the fraction [9].

5. Cytotoxicity activity of Acrostichum aureum

Acrostichum aureum leaf methanolic extract demonstrated specific cytotoxicity (IC50: 1.02 mg/ml) against a variety of cancer cell lines, including HT-29, NIH 3T3, MDAMB-231, MCF-7, and AGS [9].

Using the sulforhodamine B assay, compounds extracted from Acrostichum aureum's methanol extract were tested for "in vitro cytotoxicity against Hep-G2, SKLU-1, and MCF-7 cells". Only (+)-pinoresinol-4-O-sulfate shown modest cytotoxic action against the tested cell lines out of the eight compounds evaluated; IC50 values for Hep-G2, SKLU-1, and MCF-7 cells were 64.73 ± 5.33, 65.54 ± 6.47, and 73.78 ± 5.86, respectively. Among Chinese medicinal herbs from Hainan that were tested for cytotoxic action against HeLa human cervical cancer cells, "the ethyl acetate extract of Acrostichum aureum" demonstrated high cytotoxicity with an IC50 value of 6.3 µg/mL [3].

Table 3: Pharmacological activities of Acrostichum aureum

Plant part	Solvent used for extraction	Use
Root	Ethanol	Anti-inflammatory activity

Whole plant	Ethanol	Antioxidant activity
Whole plant	Ethanol	Analgesic activity
Whole plant	Ethanol and acetone	Anti-fertility activity
Leaves	Methanol	Cytotoxicity activity

D. Phytochemical Constitutions of Acrostichum Aureum

Phytochemicals are bioactive substances found in a variety of plants that serve essential purposes for the plants, such as protecting them against harsh environmental factors and predators [12]. Additionally, because these phytochemicals contain a number of advantageous biological activities, such as anti-inflammatory, antioxidant, and antibacterial properties, they have important medical and pharmacological properties. Secondary metabolites include "flavonoids, gum, sterols, glycosides, saponins, alkaloids, gums, tannins, terpenoids, and triterpenoids" are abundant in various areas of Acrostichum aureum [3].

According to Acrostichum aureum's initial phytochemical screening, the plant has a high concentration of phytochemicals in its crude methanolic extract, including terpenoids, alkaloids, flavonoids, and saponins. The crude methanolic extract of the leaf, rachis, and rhizome demonstrated the presence of alkaloids, which constitute one of the most extensive classes of compounds produced by plants [13]. Whether or not proteins have been broken down beforehand, these alkaloids are produced from nitrogenous materials. Alkaloids, which are found in plants, have been used to treat a variety of illnesses, such as cancer, asthma, diarrhoea, pain, poor blood circulation, and malaria. The methanolic extracts of Acrostichum aureum were determined to contain flavonoids, as evidenced in the study. Because flavonoids have been demonstrated to have antibacterial qualities, they can help heal wounds and cure skin conditions [14].

E. Traditional uses

In many nations across the world, different portions of "Acrostichum aureum" are historically used to treat a variety of illnesses and disorders (Table 4). Skin conditions like abscesses, which can cause boils and a deep red discolouration of the afflicted region, are treated with Acrostichum aureum [5]. The leaves are used to make ointments, lotions, and creams to treat skin ailments. Native people in Malaysia, Sri Lanka, and Vietnam utilise crushed or powdered rhizomes to cure wounds, boils, non-healing ulcers, and to halt bleeding. In Sri Lanka, the leaves are also used to cure inguinal hernias, haemorrhoids, gastritis, and dysentery.

The roots and fertile fronds are used to cure diabetes, pharyngitis, and syphilitic ulcers, while the Indians utilise the frond as an antidote for poisonous snakebite. Fijian indigenous people utilise various sections of Acrostichum aureum to cure constipation, asthma, elephantiasis, fever, chest aches, and sore throats. In Fiji, it is also thought to be effective in raising the likelihood of a healthy pregnancy. Additionally, it helps cure respiratory conditions including sinusitis and throat infections. Keralans utilise the plant as an anthelmintic, styptic, and astringent to stop bleeding [3].

Table 4: Traditional medicinal uses of Acrostichum aureum [3]

Country/Region	Part Used	Uses in Traditional Medicine
India	Fronds	Antidote for venomous snakebites
	Fronds	Antifungal
India	Fronds and roots	Syphilitic ulcers, pharyngitis, chest pain, diabetes
Malaysia	Rhizomes	Wounds, snake bite, boils
	Fronds	Hypotension, worms, digestive issues
Fiji	Plant	Sore throat, chest pains, elephantiasis, purgative, febrifuge
Bangladesh	Leaves	Cure cloudy urine in women
Bangladesh	Rhizome	Wounds, peptic ulcers, boils
Malaysia	Leaves	Stop bleeding
China	Rhizome	Worm remedy, inveterate ulcers
		Bladder complaints
Borneo	Fertile fronds	Syphilitic ulcers
Costa Rica	Leaves	Emollients
Kerala	Whole plant	Astringent in hemorrhage
Panama	Young fiddleheads	Medicinal bath for infant
Vietnam	Rhizome	Wound healing

Colombia	Young fiddleheads	Extract fish bones from the throat
Suriname	—	Abortifacient
Nigeria	Roots	Baby lotion
Nigeria	Leaves	Skin infection and stomach pain
Sri Lanka	Rhizome	Hemorrhoids, gastritis, dysentery, inguinal hernia
Indonesia	—	To stop bleeding and relieve pain

II. LITERATURE REVIEW

(Basyuni et al., 2025) [15] "The food and medicinal potential of mangrove species in Indonesia" was examined in this systematic study, which was enhanced by the inclusion of pertinent international perspectives. According to the research, the most often used mangrove species for food are "Nypa fruticans and Bruguiera gymnorrhiza", whose leaves, fruits, and plant sap are either eaten raw or processed into goods like flour, syrup, and fermented drinks. In addition to their nutritional worth, these meals generated from mangroves have cultural and traditional significance for the local inhabitants. This analysis highlights how mangrove-derived foods and medicines promote coastal food security, improve health, and help accomplish global sustainability objectives, especially "SDG 2 (Zero Hunger) and SDG 15 (Life on Land)".

(Benny et al., 2024) [16] A mangrove fern in the Division Pterophyta is Acrostichum aureum Linn. According to reports, the plant's rhizome and leaves offer a number of therapeutic benefits. Unfortunately, there are currently no data on phytochemical analysis of the hexane extract of this plant's leaves. Therefore, an effort has been undertaken to examine the phytochemicals found in the hexane extract of Acrostichum aureum Linn. leaves. According to the examination, phytochemicals including "alkaloids, glycosides, flavonoids, tannins, phenols, saponins, proteins, and carbohydrates" are present in the hexane extract of Acrostichum aureum Linn. The primary chemical identified by the GC-MS study was eucalyptol, a monoterpenoid, followed by alpha-terpinyl acetate, a naturally occurring monoterpenoid. It was determined that a variety of phytochemicals present in the hexane extract of Acrostichum aureum are responsible for its therapeutic effects.

(Abiola & Adetutu, 2021) [13] Chronic conditions include "cancer, heart failure, pulmonary embolism, diabetes, arthritis, headaches, and stroke"—all of which present formidable therapeutic challenges—all benefit greatly from inflammation. Investigations were conducted on the anti-inflammatory effects of cleansed ethanolic crude selection of Acrostichum aureum leaf. With a reduction in paw volume of 65.90% (P0.01) after 24 hours at a dosage of 400 mg/kg body mass, the extract showed significant anti-inflammatory activity in the carrageenan-induced oedema impact in rats, which is comparable to that produced by the common medication indomethacin (66.66%). The results support the use of refined ethanolic crude extract from Acrostichum aurum leaves in traditional medicines by demonstrating their anti-inflammatory qualities.

(A & Joseph, 2021) [12] Pteridophytes have been found to be relatively resistant to microbial pathogen infection, which may be because of the different phytocompounds that these plants contain. The current study examines the phytochemical and antibacterial properties of three members of "the Pteridaceae family: Acrostichum aureum L., Pteris vittata L., and Adiantum philippense L". Several phytocompounds were found in the extract of the chosen plants, including "Acrostichum aureum L., Pteris vittata L., and Adiantum philippense L.", according to phytochemical examination. Gramme negative and gramme positive microorganisms, including "Escherichia coli, Klebsiella pneumonia, Pseudomonas aeruginosa, and Staphylococcus aureus", were used to test the antibacterial activity of extracts of certain pteridophytes. All four bacteria are inhibited by "Acrostichum aureum, E. coli and Staphylococcus aureus" are inhibited by Pteris vittata, and Klebsiella pneumonia and E. coli are inhibited by Adiantum philippense.

(Vadivel & Badhsheeba, 2021) [17] Finding the bioactive components in medicinal plants by preliminary screening of phytochemicals is a useful first step that might eventually lead to the creation of new drugs. The primary phytoconstituents of the Pteridaceae family's "Acrostichumaureum L (Fern) medicinal plant" were determined in this study in order to correlate their existence with the plants' bioactivities. These results demonstrate that, when compared to other solvent extracts, "methanolic extracts of Acrostichum aureum leaves" had the greatest quantity of phytochemicals. As a result, "methanolic extracts of Acrostichum aureum leaves" have significant medicinal utility and the potential to cure a wide range of human ailments.

(Basyuni et al., 2019) [18] explains the study of favoured real mangrove leaves, such as "Acrostichum aureum,

Bruguiera gymnorrhiza, Ceriops tagal, Nypa fruticans, and Rhizophora mucronata, using phytochemical, physicochemical, and microscopic methods". Mangrove leaves were subjected to the standard protocol for phytochemical screening. Using the WHO approach, simplicized grain including "moisture content, water-soluble, ethanol-soluble, ash-content, and essay extract" were used to identify the physicochemical properties of photosynthetic mangrove tissues. A noteworthy outcome was less than 10% water content, which is a necessity for therapeutic development. Physicochemical properties also reveal combinations between the species. A variety of stomata types were found in mangrove leaves by microscopic analysis. For instance, B. gymnorhhiza and R. mucronata had anomocytic stomata, whereas A. aureum and C. tagal had anisocytic stomata. Only N. fruticans had a monocotyledon that allowed for type differentiation. Potential pharmacological properties from mangrove leaves may be provided by the current research.

(M & Vadivel, 2019) [7] provides information on standardisation, including "moisture content, total ash, acid insoluble ash, water soluble ash, petroleum soluble otal ash, acid insoluble ash, water soluble ash, petroleum soluble extractive value, benzene soluble extractive value, ethyl acetate soluble extractive value, ethanol soluble extractive value, methanol soluble extractive value, water soluble ethanol soluble extractive value, and water soluble extractive value". The purpose of this study is to link their existence to the plants' bioactivities. The results of this study demonstrate that, in comparison to other solvent extracts, methanolic extracts of Acrostichum aureum rachis had the greatest quantity of phytochemicals. Therefore, phytochemical methanolic extracts are different from conventional solvent extracts. Therefore, Acrostichum aureum rachis methanolic extracts have the highest potential to cure a wide range of human disorders and have deep medicinal relevance.

III. RESEARCH OBJECTIVE

1. To study the Morphology and Taxonomical classification of Acrostichum Aureum,
2. To study the Ethnomedical Information and traditional use of Acrostichum Aureum.
3. To study the Pharmacological Activities and Phytochemical Constitutions of Acrostichum Aureum.
4. To study the various literature's work on Pharmacological Activities, Phytochemical Constitutions and traditional use of Acrostichum Aureum.

IV. RESEARCH METHODOLOGY

The research methodology for this review involved a systematic literature search across major scientific databases, including PubMed, Scopus, Web of Science, Google Scholar, and ScienceDirect. Keywords such as Acrostichum aureum, phytochemical composition, pharmacological activity, medicinal plants, and bioactive compounds were used. Studies published between 2015 and 2025 were screened based on relevance, scientific validity, and focus on phytochemical or pharmacological evaluations. Data from peer-reviewed articles, dissertations, and ethnobotanical reports were extracted, compared, and synthesized. Publications lacking methodological clarity or reliable experimental evidence were excluded to ensure accuracy and quality of the review.

V. CONCLUSION

Acrostichum aureum emerges as a valuable medicinal plant with diverse ethnomedical relevance and significant pharmacological potential. The literature indicates that its rich phytochemical profile—comprising alkaloids, flavonoids, terpenoids, saponins, and essential amino acids—contributes to its wide-ranging therapeutic effects. The presence of phenols and flavonoids suggests strong antioxidant properties, supporting its role in preventing oxidative stress–related diseases. Additionally, its antibacterial, anti-inflammatory, and wound-healing activities validate its traditional applications in treating skin infections, ulcers, fever, asthma, and other ailments. Despite promising findings, further studies are required to isolate, characterize, and validate its bioactive compounds for clinical use. Continued research will enhance understanding of its pharmacological mechanisms and support the development of novel therapeutic agents derived from this fern. Acrostichum aureum thus represents a potent natural resource with substantial potential for future drug discovery and clinical applications.

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