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ANTI BACTERIAL ACTIVITY AND ANTI DIABETIC ACTIVITY OF PLANT SZYGIUM ALTERNIFOLIUM AND THEIR PHYTOCHEMICAL CONSTITUENTS

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ABSTRACT

The antibacterial properties of Syzygium alternifolium, a medicinal plant native to various parts of Asia, have gained interest in recent years. This review explores the antibacterial potential of the plant, its bioactive components, and the methods used to evaluate its efficacy against bacterial pathogens. Findings from multiple studies highlight its promising role in combating bacterial infections, particularly against resistant strains. The paper also discusses the challenges and future perspectives of using S. alternifolium as an alternative or adjunctive therapy. Diabetes, characterized by hyperglycemia, is one of the most significant metabolic diseases, reaching alarming pandemic proportions. It can be due to the defects in insulin action, or secretion, or both. The global prevalence of diabetes is estimated at 425 million people in 2017, and expected to rise to 629 million by 2045 due to an increasing trend of unhealthy lifestyles, physical inactivity, and obesity. Several treatment options are available to diabetics, however, some of the antidiabetic drugs result in adverse side effects such as hypoglycemia. Hence, there has been a proliferation of studies on natural products with antidiabetic effects, including plants from the

Myrtaceae family, such as *Psidium guajava*, *Eucalyptus globulus*, *Campomanesia xanthocarpa*, and more significantly, *Syzygium* sp. Previous studies have shown that a number of *Syzygium* species had potent antidiabetic effects and were safe for consumption. This review aims to discuss the antidiabetic potential of *Syzygium* sp., based on *in vitro* and *in vivo* evidence.

INTRODUCTION

Syzygium alternifolium, a member of the Myrtaceae family, is a tropical plant native to India and other parts of Southeast Asia. Traditionally, it has been used in folk medicine to treat various ailments, including gastrointestinal issues, inflammation, and infections. The antibacterial properties of this plant have gained significant attention due to the rise in antibiotic resistance worldwide. As a part of the ongoing search for natural compounds with antimicrobial activity, S. alternifolium stands out for its potential to fight bacterial infections.

Mechanism of Antibacterial Action

The antibacterial activity of Syzygium alternifolium can be attributed to several mechanisms:

Cell Wall Disruption: Compounds such as tannins and flavonoids may interfere with the synthesis of bacterial cell walls, leading to cell lysis.

Enzyme Inhibition: Alkaloids and phenolic compounds in the plant may inhibit bacterial enzymes involved in vital processes like DNA replication and protein synthesis.

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Membrane Permeabilization: Essential oils in S. alternifolium may disrupt bacterial cell membranes, increasing permeability and causing leakage of cellular contents, which leads to cell death.

Diabetes mellitus is a major global health concern, with millions of individuals affected worldwide. It is a chronic condition characterized by high blood glucose levels, either due to insufficient insulin production or the body's inability to use insulin effectively. As conventional treatments may not always be sufficient or have side effects, there is growing interest in plant-based medicines for diabetes management. Syzygium alternifolium, a plant belonging to the Myrtaceae family, has been recognized in traditional medicine for its

therapeutic properties, including its potential to regulate blood glucose levels. This paper aims to explore the antidiabetic activity of Syzygium alternifolium through a review of its phytochemical composition, biological activities, and mechanisms that may contribute to its potential therapeutic effects.

Mechanisms of Antidiabetic Activity

Regulation of Blood Glucose Levels

The primary benefit of Syzygium alternifolium for diabetic patients is its ability to lower blood glucose levels. Studies have indicated that extracts from the plant can reduce fasting blood glucose (FBG) and improve glucose tolerance in animal models of diabetes. The mechanisms underlying this action include:

Enhancement of Insulin Sensitivity: Certain bioactive compounds in the plant may enhance insulin receptor activity, improving the body's response to insulin and facilitating better glucose uptake by cells.

Inhibition of Alpha-Glucosidase: Alpha-glucosidase inhibitors delay the breakdown of carbohydrates into glucose, thus preventing postprandial hyperglycemia.

Stimulation of Insulin Secretion: Some studies suggest that the plant's compounds may stimulate pancreatic beta cells to secrete more insulin, thereby promoting lower blood sugar levels.

PLANT PROFILE OF SYZGIUM ALTERNIFOLIUM

REGIONAL NAME

Mogi,

Movi,

Manchi moyadi,

SOURCE BIOLOGICAL

It consists of dried leaves, barks, of the plant known as Syzygium alternifolium.

FAMILY:- Mytaceae

GEOGRAPHICAL SOURCE

It is commonly found on the foot hills of Tirumala forest. Particularly the species distributed extensively through to an altitude of about 300 m from Vinayaka temple northwards to north-east and extending west and south-west to the temple upto Galigopuram.

HABITAT

This is well known tree, it grows upto 12-15 feet in height. These species grow well drained and grows in all varieties of soil.

TAXONOMICAL CLASSIFICATION

Kingdom	:	Plantae
Subkingdom	:	Tracheobionta
Superdivision	:	Spermatophyta
Division	:	Angiosperms
Class	:	Eudicots
Subclass	:	Rosidae
Order	:	Myrtales
Family	:	Mytaceace
Genus	:	Syzygium

BOTANICAL DESCRIPTION

Syzygium alternifolium is a species of tree or shrub in the family Myrtaceae, commonly found in tropical regions. Here's a botanical description of the species:

Habit: It is a small to medium-sized tree or shrub, typically growing up to 6 meters in height.

Leaves: The leaves are alternate, simple, and lanceolate or elliptic in shape, with entire margins. The leaf blades are usually glossy, dark green, and have a prominent midrib.

Flowers: The flowers are small, typically white or cream-colored, and arranged in clusters. They possess numerous stamens, giving them a fluffy appearance.

Fruit: The fruit is a berry, often purple or dark-colored when ripe, containing numerous seeds.

Habitat: Syzygium alternifolium typically grows in tropical and subtropical areas, often in coastal forests or near water bodies.

Uses: Like many species in the Syzygium genus, it may have medicinal, ornamental, or ecological value.

PHENOLOGY

Leaf fall	:	February-June
New foliage	:	June - september
Flowering	:	June -september
Fruiting	:	March – June

Phytochemistry of Syzygium alternifolium

The antibacterial properties of S. alternifolium are largely attributed to its bioactive compounds. Several phytochemical classes have been identified, including:

Flavonoids: Known for their antioxidant and antimicrobial activities, flavonoids in S. alternifolium may contribute significantly to its antibacterial properties.

Alkaloids: These compounds are often associated with antimicrobial effects. Alkaloids found in the plant may disrupt bacterial cell walls or inhibit bacterial enzymes, contributing to the plant's antibacterial efficacy.

Tannins: Tannins have astringent and antimicrobial properties, making them potent agents against bacterial infections.

Phenolic Acids: These compounds possess strong antimicrobial effects and are often responsible for the antibacterial activities of many plant extracts.

Essential Oils: Many plants in the Myrtaceae family, including S. alternifolium, are rich in essential oils, which exhibit strong antibacterial properties, especially against Gram-positive bacteria.

Botanical Description and Phytochemical Composition

Syzygium alternifolium is a flowering plant found predominantly in tropical regions, particularly in parts of Southeast Asia. It is known for its rich array of bioactive compounds, which contribute to its medicinal properties. The plant contains a variety of secondary metabolites, including:

Flavonoids: Known for their antioxidant and anti-inflammatory properties, flavonoids can modulate glucose metabolism and protect against oxidative stress.

Tannins: These compounds possess antimicrobial and anti-inflammatory properties, which may help in managing diabetes-related complications.

Alkaloids: Alkaloids are often associated with antimicrobial and blood sugar-lowering effects.

Saponins: These compounds are believed to have antidiabetic, hypolipidemic, and anti-inflammatory effects.

Phenolic compounds: Phenolic acids are known for their antioxidant activities and potential role in glucose regulation.

These compounds have been shown to possess diverse biological activities, which can contribute to the antidiabetic effects of the plant.

Methodologies for Evaluating Antibacterial Activity

Various methods are employed to evaluate the antibacterial activity of plant extracts. These include:

Disc Diffusion Method: This is one of the most commonly used methods to determine the antibacterial activity of plant extracts. In this method, paper discs impregnated with the plant extract are placed on agar plates inoculated with bacterial cultures. The inhibition zone formed around the disc indicates the antibacterial effectiveness of the extract.

Agar Well Diffusion Method: Similar to the disc diffusion method, this technique uses wells created in the agar medium to assess antibacterial activity. The test substance is placed in the well, and the area of inhibition is measured.

Minimum Inhibitory Concentration (MIC): The MIC test determines the lowest concentration of the plant extract that prevents the visible growth of the bacteria. This test provides quantitative data on the potency of the extract.

Pharmacological Studies on Syzygium alternifolium

Several animal-based and in vitro studies have provided evidence supporting the antidiabetic effects of Syzygium alternifolium.

In Vivo Studies

Animal models, particularly diabetic rats and mice, have been used to assess the hypoglycemic effects of the plant's extracts. In some studies, diabetic rats treated with Syzygium alternifolium extracts showed a significant reduction in blood glucose levels. Additionally, the plant was found to improve the lipid profile and reduce oxidative stress

markers, suggesting a comprehensive therapeutic effect on both glucose metabolism and cardiovascular health.

In Vitro Studies

In laboratory settings, the ability of Syzygium alternifolium extracts to inhibit alpha-glucosidase and modulate other enzymatic activities related to carbohydrate metabolism has been confirmed. These findings indicate that the plant may provide a multi-targeted approach to managing diabetes by not only lowering blood glucose but also preventing excessive carbohydrate absorption from the digestive system.

CONCLUSION

Syzygium alternifolium is a promising plant with significant antibacterial properties, owing to its diverse bioactive compounds. While early studies suggest its potential, further research, including clinical trials and toxicity assessments, is required to fully understand its therapeutic value. If proven safe and effective, S. alternifolium could provide a valuable alternative or adjunct to conventional antibiotics in treating bacterial infections, particularly in the face of rising antibiotic resistance.

The antidiabetic potential of Syzygium alternifolium is supported by a growing body of evidence from phytochemical analysis and preclinical studies. Its ability to lower blood glucose levels, improve insulin sensitivity, and offer antioxidant and anti-inflammatory benefits positions it as a promising candidate for future diabetes therapies. However, more rigorous clinical research is required to fully understand its mechanisms and potential as an adjunct or alternative treatment for diabetes. As interest in plant-based therapies continues to rise, Syzygium alternifolium represents a valuable area for further investigation in the quest for safer and more effective treatments for diabetes.

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