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A REVIEW ON PHYTOCOMPOUNDS AND PHARMACOLOGICAL ACTIVITIES FOR *MUSA PARADISIACA* LINN.

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ABSTRACT

Musa paradisiaca Linn. is a well-known Indian medicinal plant from the Musaceae family. This plant, also known as plantain or banana, produces highly nutritious fruit all over the world. A broad range of phytochemical constituents have been isolated from this plant. The fruits and other parts of the plant are used to treat various diseases in humans by traditional medicine. This review study gives scientific information on medicinal uses, phytochemistry of *Musa paradisiaca* plant parts are widely used to treat different diseases in humans such as diabetes, diarrhoea, hypertension, dysentery, hysteria, leprosy, epilepsy, haemorrhages, renal calculi and ulcers. The main pharmacological activities of this plant are antidiabetic, antioxidant, antidiarrhoeal, antidepressant, antiulcer, antimicrobial, antilipidemic, antihypertensive, antisnakevenom, wound healing, Antiatherosclerotic Activity, hair growth promoting and antimutagenic activity. This review present scientific information on morphology, traditional uses, phytochemistry and pharmacological activities of *Musa paradisiaca*.

Keywords: *Musa paradisiaca*, antidiabetic, antioxidant, antidiarrhoeal

INTRODUCTION

Traditional medicine frequently employs medicinal plants to treat a variety of diseases.

The fruit *Musa paradisiaca* (Linn), is a known as the plantain banana, belongs to the

Musaceae family and it is indigenous to India and Burma. It thrives in subtropical and tropical environments. Banana is a essential food in numerous countries due to its high

nutritional value. The fruits and other parts of the plant shows different medicinal properties and there is a high demand for *Musa paradisiaca* in both the Indian and international markets. Plant is known to have nervine tonic properties. It has been reported that the plant has anti-diarrheal, anti-ulcerative, antimicrobial, hypoglycemic, antioxidant, antihypertensive, anti-atherosclerotic, anti-malarial, anti-snake

venom, mutagenic, hepatoprotective, hair growth-promoting, and pain-relieving properties. In this review throughout the study of the morphology, phytochemical constituents, traditional uses, pharmacological activities reported are included in view of the many recent discoveries of importance on this plant [1].

TAXONOMY

| | |
|-----------------------|----------------------|
| Kingdom | Plantae |
| Subkingdom: | Tracheobionta |
| Division | Magnoliophyta |
| Super division | Spermatophyta |
| Class | Liliopsida |
| Subclass | Zingiberidae |
| Order | Zingiberales |
| Family | Musaceae |
| Genus | Musa |
| Species | Paradisiaca |

OCCURANCE AND GEOGRAPHICAL DISTRIBUTION

It is a persistent herb that grows 10-40 feet in height and is usually found in tropical and subtropical areas. It is found in all tropical areas of Burma and India. It is most common in Tamil Nadu, Bihar, Andhra Pradesh,

Madhya Pradesh, Maharashtra, West Bengal, and Gujarat in India. It is also found in Australia, America and tropical Africa. Cultivation is only permitted in Florida, The Canary Islands, Southern Japan, Egypt, and Southern Brazil [2].



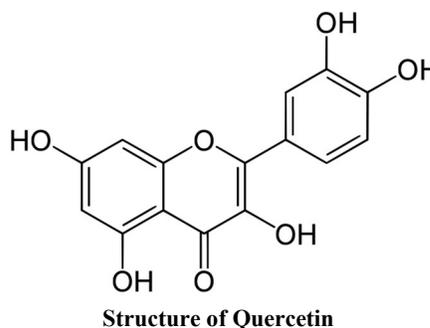
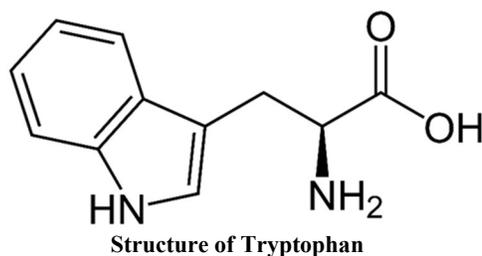
Figure 1: Fruits of *Musa paradisiaca* linn

MORPHOLOGY

Musa paradisiaca (Musaceae), commonly known as plantain. *M. paradisiaca* is a herbaceous plant that can grow up to 9 meters in length. The plantain pseudostem (made up of leaves and their fused bases) can grow to a height of 7-20 inches and has a crown of large elongated oval deep-green leaves (up to 365 cm long and 61 cm wide) with a prominent midrib. It has green-whitish flowers with long barbs [3]. *Musa paradisiaca* commonly referred as a "tree," is a large herb with a succulent, extremely juicy stem that is a cylinder of leaf-petiole sheaths that grows to a height of 20 to 25 ft (6-7.5 m) and arises from a fleshy rhizome or corm. Leaves are smooth, tender, elliptic or oblong [4].

PHYTOCHEMISTRY

Fruit



Flower

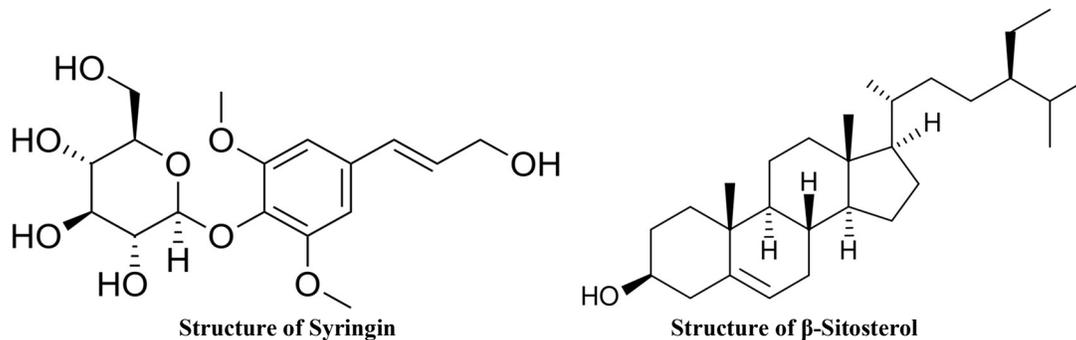
Flower extracts contained dopamine, serotonin, noradrenalin, caffeic, p-coumaric, cinnamic, ferulic, gallic, campesterol, protocatechuic acids, stigmasterol, b-

The fruit extract of plant contains high concentration of serotonin, dopamine and norepinephrine. The peel of fruit contains serotonin (47-93g/g), norepinephrine (122g/g), and dopamine (700g/g). The fruit extract also contains tryptophan which helps in the restoration of essential neurotransmitters. Furthermore, bananas are high in a variety of nutritional elements that can aid in the treatment of mood disorders [5]. Crystallizable and non-crystallizable sugars, vitamin B and C, albuminoids, fats, minerals, pectin, tannin, starch, iron, and numerous flavonoids and related compounds, such as quercetin, leukocyanidin, and its 3-O-rhamnosyl glucoside, 3-O-galactoside and 3-O-glucoside, have been found specifically in the pulp of *M. paradisiaca* fruit [6].

sitosterol, cyclomusalenol, and cyclomusalenone [5]. The presence of steroids, alkaloids such as Beta-sitosterol, saponins, flavonoids such as quercetin, tannins, reducing sugar, and anthraquinones

in *Musa paradisiaca* stem extracts using chemical tests, UV, IR, Flame photometric, and HPTLC studies [7]. A new hemiterpenoid glucoside named 1,1-dimethylallyl alcohol -

glucoside was isolated from *Musa paradisiaca* flower buds, along with three known compounds, benzyl alcohol glucoside, syringin, and (6S, 9R)-roseoside [8].



| Chemical Constituents | Plant Part |
|-----------------------|------------|
| 5-Hydroxytryptamine | Fruit |
| Beta-Sitosterol | Leaf |
| Alanine | Fruit |
| Tryptophan | Fruit |
| Iron | Flower |
| Serotonin | Fruit |

PHARMACOLOGICAL ACTIVITIES

Musa paradisiaca Linn. has a various effect that have been documented in both traditional and scientific literature. This plant's main pharmacological effects are anti-diabetic, anti-ulcer, and antioxidant, diuretic, analgesic, enhancing action on skeletal muscular contraction, wound healing, hair growth promotion, mutagenesis effects, antihypertensive activity, anti-allergic activity effects are a few of the reported effects [9].

Antidiabetic activity:

The current study data found that treating diabetic rats with *M. paradisiaca* leaf and peel

hydroethanolic extracts resulted in a significant decrease in serum glucose at a dose of 100 mg/kg b.w. These hypoglycemia effects could be a result of the compounds contains Sterols, phytol, vitamin E, Linoleic acid, and plamitic acid were all detected in the GC-MS analysis of the *M. paradisiaca* extract. These substances have been shown to have an anti-hyperglycemic effect. The oral administration of *M. paradisiaca* leaf and peel extracts caused a significant increase in serum insulin levels, as well as increased values of HOMA-IS and HOMA- cell function; thus, the improvement in glucose homeostasis is

likely due to an improvement in insulin action and secretion [10].

The anti-diabetic activity of methanol and hydroalcoholic extracts of *Musa paradisiaca* stem was evaluated. According to the studies, the extracts effectively inhibit alpha glucosidase and alpha amylase enzymes in vitro in a dose-dependent manner [5].

Antioxidant activity

Extracts of *Musa paradisiaca* were found to stimulate the activities of superoxide dismutase (SOD) and catalase, which may be responsible for the lower levels of peroxidation products such as hydroperoxides.^[5] Methanol extracts of Banana flower have inhibitory effects that stabilize the free radicals produced as a result of several metabolic processes in the body. If the free radicals don't appear to be neutral, their unsteady electrons interact with the polymer and proteins of human cells and change their characteristics. This can lead to a various chronic condition, including cancer and cardiovascular disease. As a result, banana flower extract is extremely useful in the development of antioxidant supplements to prevent oxidation in humans [11].

Antidiarrheal activity

Flavonoids could be responsible for the antidiarrheal activity by inhibiting intestinal motility and hydroelectrolytic secretion.

While tannins' astringency may account for its antidiarrheal activity by denaturing protein constituents of the intestinal mucosa and forming protein tannates. Additionally, saponins have anti-diarrhoeal properties by inhibiting the release of histamine [12].

Antidepressant Activity

The fruit of the banana that contains high concentration of serotonin, norepinephrine, and dopamine. The peel of fruit contains serotonin (47-93g/g), norepinephrine (122g/g), and dopamine (700g/g). Banana also contains tryptophan that helps in restoration of essential neurotransmitters. Also, banana is a rich source of various nutritional elements that can help in treatment of mood disorders. Bananas are a rich source of several nutrients, including those that can assist in the treatment of mood disorders [5].

Antiulcer activity

The growth of eicosanoids in human viscous and intestinal membrane incubates was observed to be inhibited by the antiulcer activity of plantain banana tree tincture. The water extract proved ineffective, however the plant fruit tincture causes antagonist activity within the eicosanoid. The effectiveness of plantain banana pulp methanolic extracts against *H. pylori* in vitro and in two-hour cold restraint stress tests was evaluated [13].

Antimicrobial Activity

Aqueous extract of *Musa paradisiaca* leaves and unripe fruit showed antimicrobial efficacy in a dehydrogenase assay against *Staphylococcus* and *Pseudomonas* species. Fruit peel extract was more effective against *Staphylococcus* (gram-positive) than *Pseudomonas* species, and it was more effective against both bacteria than leaf extract (gram-negative) [14].

Antilipidemic Activity

In comparison to control rats fed fiber-free diets, animals fed neutral detergent fibre from unripe bananas demonstrated significantly lower serum and tissue levels of cholesterol and triglycerides in both cholesterol diet and cholesterol free diet groups. Rats fed neutral detergent fibre from unripe bananas in both groups had higher concentrations of hepatic bile acids and neutral sterols and bile acid excretion from the faeces. Rabbits' absorption of glucose and cholesterol was dramatically reduced only when neutral detergent fibre from unripe bananas was present [15].

Antihypertensive Activity

In rats that had been made hypertensive by deoxycorticosterone enantate (DOC, 25 mg/rat), ripe banana pulp (50 g/rat/day) had an antihypertensive effect. The high tryptophan and carbohydrate content of bananas, which raise serotonin levels and provide a serotonin-mediated natriorexic action, may be the cause

of this effect. The aqueous extract of plantain (*Musa paradisiaca*) has a concentration-dependent hypotensive effect on rat portal vein and aortic rings that had been isolated after being contracted by potassium chloride and noradrenaline [16].

Wound healing

The antioxidant properties of plantain extracts, including those that have been reported on numerous occasions such as apigenin, shogaol, myricetin, isorhaemnetin, capsaicin, luteolin, caffeic acid, p-hydroxybenzoic acid, quercetin, kaempferol, glycitein, and gingerol can also play an important role in healing process [17].

Anticancer activity

It was reported that DMSO, saline, peel extract, and HAuCl₄ performed worse than other controls while plantain peel aqueous extract-synthesised gold nanoparticles significantly inhibited in vitro A549 lung cancer cells at a dosage between 25 and 100 g/mL. The apoptotic pathway was believed to be in charge of the cytotoxic activity, and the IC₅₀ was calculated to be 58 g/mL [18].

Antiatherosclerotic Activity

M. paradisiaca prevents the crystallization of cholesterol in vitro. It has been found that *Musa paradisiaca* peel extract has anti-atherosclerotic properties in rats with diet-induced atherosclerosis. This may be because

the extract contains dopamine, ascorbic acid, and other antioxidants. However, concurrent administration of *M. paradisiaca* extract reduced most of the biochemical and histopathologic changes brought on by the CCT diet, pointing to the fruit peels' potential usefulness as a preventative measure against thyroid and atherosclerotic disease [19].

Hepatoprotective activity

M. paradisiaca has ability to protect the liver from CCl₄-induced hepatic damage was further demonstrated by its ability to inhibit the histological changes that CCl₄ causes. The scavenging of free radicals that are responsible for the CCl₄'s toxicity may be the likely mechanism of action. The elevated levels of serum enzymes such as serum glutamic-oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), alkaline phosphatase (ALP), and bilirubin levels were reduced by pretreatment with alcoholic extract (500 mg/kg), more significantly and to a lesser extent, the alcoholic extract (250 mg/kg), and aqueous extract (500 mg/kg) [20].

Hair growth Promoting Activity

By measuring hair length and examining follicles under a microscope in vehicle-control, 2%-minoxidil-treated, and extract-treated mice, researchers were able to determine the influence of an aqueous and

methanolic extract of unripe *M. paradisiaca* fruits on the activity that promotes hair development. It shows potential as a hair growth stimulant because animals treated with aqueous and methanolic extract of *M. paradisiaca* displayed improved efficacy when compared to the control and standard group [21].

Reproductive activity

Adult male Wistar rats were used to study the effects of administering mature green fruits of *Musa paradisiaca* powder dissolve in distilled water (500 mg/kg, 1000 mg/kg) on the semen quality. Animals who received a lesser dose of the plantain flour showed a considerable improvement in the semen parameters, whereas those that received a higher dose showed a marked and very significant decrease in sperm cell concentration and the proportion of morphologically normal spermatozoa [22].

CONCLUSION

In many tropical areas, *Musa paradisiaca* Linn. is widely dispersed. The fruit from *Musa paradisiaca* Linn. is the most popular and commonly consumed fruit in the entire world. The various morphological and microscopic traits that have been discussed here serve to identify the plants. The herb appears to have a wide range of therapeutic effects on many diseases. Analgesic, adaptogenic,

anticonvulsant, antiulcerative, antimicrobial, antioxidant, antilipidemic, antihypertensive, antiatherosclerotic, cytotoxic, thrombolytic, antimalarial, and antisnakevenom properties of the plant have all been investigated in various parts of the plant. According to reports, it contains catecholamines, proteins, flavonoids, sterol glycosides, vitamins, and minerals. With access to primary data, additional research can be done, including clinical evaluations, phyto-analytical tests, and toxicity evaluations. The plant has undergone some pre-clinical testing; if these claims are verified through scientific and clinical research, it may offer effective treatments for a variety of human illnesses.

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