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### A Review: Pharmacognostic studies and Pharmacological actions of *Musa Paradisiaca*

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#### ABSTRACT

In Ayurveda, a traditional system of medicine *Musa Paradisiaca* is commonly used in Asthma, Diabetes, Anthelmintic, Hypertension, Insomnia, Snake bite. The whole plant as well as specific parts (leaves,ripe and unripe fruits, stems) of plant extract and its active constituents have been used for the treatment of large number of human ailments. Several epidemiological and experimental studies have demonstrated the multiple biological activities of *Musa Paradisiaca*. This review summarizes the most interesting studies on the various pharmacognosy and pharmacological works done on the *Musa Paradisiaca*.

**Keywords:** *Musa Paradisiaca* Linn, Hypertension, Insomnia, Diabetes.

#### INTRODUCTION

*Musa Paradisiaca* Linn (*Musaceae*) is prominently used in the form of Hemanta Rasa in traditional system of medicine. The term banana is Spanish-Portuguese from Guinea. Plantain refers in India to a coarse banana. Though the two terms are regarded as almost synonymous banana refers botanically to *Musa Paradisiaca*, the most familiar of tropical fruits. From its origin in India/Malaysia it spread to the tropical world. It has been cultivated for *Musa Paradisiaca* more than 4000 years, the original varieties have increased to 300.

#### HABIT AND HABITAT

*Musa Paradisiaca* is a monoecious herb. It grows 10-40 feet in height and has enormous broad green leaves which grows through hollow stem bears flower and fruit. It occurs in all tropical areas native to India and Burma<sup>2</sup>. It is also distributed in Newguinea, America, Australia and tropical Africa. Cultivation is limited to Florida, The Canary Islands, Egypt, Southern Japan, South Brazil.

#### TRADITIONAL USES

In Ayurveda, a traditional system of medicine *Musa Paradisiaca* is cited for treatment of many disorders. Its leaves can be used in the treatment of cough and bronchitis. Roots are used to arrest hemoptysis, possess strongly astringent and as an Anthelmintic. Fruits can increase the renal activities, reduces the risk of kidney cancer. It contains antioxidant and counteracts the noxious effects of the free radicals. *Musa Paradisiaca* can be used as antidote for snake bite, Asthma, burns, diabetes, dysentery, excessive menstrual flow, fever,

gangrene, gout, head ache, hemorrhage, inflammation, insomnia, intestinal parasites, sores, syphilis, tuberculosis, ulcers and warts. It is also used in diarrhoea, stomachaches, lack of appetite, maintaining bones healthy, gastric ulcer, strengthening the immune system, reducing the risk of hypertension, mental shock and to improve the muscular activity.

#### CHEMICAL CONSTITUENTS

Flowers consist of tannins, saponins, reducing and non reducing sugars, sterols and triterpenes<sup>1</sup>. The structure of new tetracyclic triterpine isolated from the flowers of *Musa Paradisiaca* was determined as (24R)-4 $\alpha$ -14 $\alpha$ , 24-trimethyl-5-cholesta-8,25(27)-dien-3 $\beta$ -ol (Pradeep *et al.*, 1983) Banana bracts, abundant edible residues of banana production were investigated as a potential source of natural colourant. Monomeric anthocyanin content was 32.3 mg/100gm. Other anthocyanins were 3-rutinoside derivatives of dephinidin, pelargonidin, peonidine and malvidin. Acid hydrolysis of anthocyanins revealed concomitant presence of six more anthocyanidins dephindin, cyanidin, petunidine, pelargonidin, peonidine and malvidin (Alexandra Pazmino *et al.*, 2001).

Fruits consist of carbohydrates, amino acids, sugar and starch. The skin of the fruit is rich in cellulose (10%), hemicellulose. The pulp protein was rich in arginine, aspartic acid, glutamic acid, methionine and tryptophan (Adegboyega and ketiku, 2006).

A new bicyclic diaryl heptanoid rel (3S-4Ar,10Br)-8-hydroxy-3-(4-hydroxy phenyl)-9-methoxy-4a,5,6,10b-tetrahydro-3H naphtho (2,1-b) pyran as well as four known compounds 1,2 dihydro 1,2,3 trihydroxy-

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9-(4-methoxy phenyl)phenalene (2)-hydroxy anigorufone(3), 2-(4-hydroxy phenyl)naphthalic anhydride(4) and 1,7 bis(4-hydroxy phenyl) hepta-4(E),6(E)-diene-3-one(5) were isolated from ethyl acetate soluble fraction of the methanolic extract of fruits (Jang *et al.*, 2002).

From peeled fruits of *Musa Paradisiaca* two new acyl sterol glycosides Sitoindoside-III and Sitosterol myo-inositol-beta-D-glucoside have been isolated by gradient solvent extraction and extensive chromatography (CC, GC, TLC and HPLC) (Shibnath Ghosal, 1985).

Three forms of  $\alpha$ -glucan phosphorylase from mature banana fruit pulp separated by ammonium sulfate fractionation and DEAE-cellulose chromatography (Surjeet Singh and Sanwal, 1975).

Two forms (A and B) of starch phosphorylase were found in the mature banana leaf by polyacrylamide gel electrophoresis and DEAE-cellulose chromatography. The young leaf development was accompanied by a decrease in the content of form A (Anil kumar and Sanwal, 1977).

The polysaccharide components present in the scape of *Musa Paradisiaca* were fractionated into water soluble (WSP), EDTA soluble (EDTA-SP), alkali soluble (ASP) and alkali insoluble (AISP) polysaccharide fractions<sup>11</sup>. The EDTA-SP was further fractionated by isoamyl alcohol into EDTA-SP-A and EDTA-SP-B. The homogeneity of these two polysaccharides was established by repeated precipitation with isoamyl alcohol, gel filtration chromatography and sedimentation analysis. The polysaccharide data from studies suggest that EDTA-SP-A is a branched amylopectin type polymer. The nature of the branching patterns of the polysaccharides suggests that they are unique to *Musa Paradisiaca* (Raju *et al.*, 2001). Sugar compositional analysis showed that WSP and EDTA-SP contained only D-Glc whereas ASP contained D-Glc, L-Ara and D-xyl in approximately 1:1:10 ratio respectively and AISP contained D-Glc, L-Ara and D-Xyl in approximately 10:1:2 ratio respectively WSP was further purified by complexation with isoamyl alcohol, and characterized by various analysis shown to be a amylopectin type alpha-D-Glucan (Anjaneyalu *et al.*, 1997).

The water soluble polysaccharides isolated from the vascular gel (mucilaginous exudates) of *Musa Paradisiaca* were fractionated via anion exchange chromatography into four fractions. Fractionated polymers contained arabinose, xylose and galactouronic acid as major sugars together with traces of galactose, rhamnose, mannose and glucose residues. Methylation analysis revealed the presence of a highly branched arabinogalactan type I pectin (Mondal *et al.*, 2001).

Chemical analysis for the elementary composition of the ash of the fruit peels and trunks of the tropical plantain *Musa Paradisiaca* have been undertaken. The elements categorized as trace elements generally are found to have higher mean concentrations in the fruit peels than in the trunks (except Zn) (Salema *et al.*, 1996).

## Enzymes

Sucrose synthetase is present in the highest concentration in root stock and fruit pulp considerable variations exist in the content of glucose, fructose, sucrose, starch and protein. Sucrose phosphate synthetase in the pseudo stem. Acid invertase is present in leaves, leaf sheath and fruit pulp and root stock. The maximum activity of ATP/D-phosphoglucose pyrophosphorylase is found in root stock. Hexokinase is most active in root stock. Acid phosphatase and alkaline phosphatase activity is highest in fruit pulp and pseudo stem. Glucose phosphate isomerase is most active in the root stock and lowest in the leaves (Shukla *et al.*, 1973).

## PHARMACOLOGICAL ACTIVITIES

The various effects of *Musa Paradisiaca* are documented in traditional as well as in recent scientific literature. The main pharmacological effects of this plant are antiulcer, wound healing, antioxidant, antidote for snake bite, hypoglycemic, atherogenic, augmentation of skeletal muscles.

### Antiulcer activity

Orally administered banana pulp powder was shown to have significant antiulcerogenic activity in rats subjected to Aspirin, Indomethacin, Phenyl butazone, Prednisolone, Cysteamine and in guinea pigs subjected to histamine. Banana pulp powder not only increased mucosal thickness but also significantly increases thymidine (incorporation into mucosal DNA). Histological studies showed that banana treatment sections showed a greater aggregation and intensity of pink spots when compared to controls. This study suggests that banana powder treatment not only strengthens mucosal resistance against ulcerogens but also promotes healing by inducing cellular proliferation (Goel *et al.*, 1986).

The active ulcerogenic ingredient was extracted from unripe plantain banana by solvent fractionation and identified by chromatography, spectroscopy and HPLC. As the flavanoid leucocyanidin and purified synthetic leucocyanidin demonstrated significant ( $p < 0.05$ ) protective effect against aspirin induced erosion (Lewis and Field, 1999).

Extracts of plantain (*Musa sapientum* Linn var. *paradisiaca*) was studied on the accumulation of eicosanoids in incubates of human gastric and colonic mucosa. The ethanolic extracts caused a concentration dependent increase in the eicosanoid but the water extract was ineffective (Goel *et al.*, 1989).

Methanolic extracts of plantain banana pulp was evaluated for its antiulcer and antioxidant activities in 2 hr cold restraint stress and anti *H.pylori* activity *in vitro*. The extract (50mg/kg twice daily for 5 days) showed significant antiulcer effect and antioxidant activity in gastric mucosa homogenates where it reversed the increase in ulcer index, lipid peroxidation and superoxide dismutase values induced by stress (Goel *et al.*, 2001).

### Wound healing activity

The rats were given graded doses of (50-200mg/kg/day) of aqueous and methanolic extract of *Musa Sapientum* var *Paradisiaca* orally for a period of 10-21 days depending upon the type of study.

**Chemical constituents present in *Musa Paradisiaca***

Part of plant	Chemical constituents	Isolation method
Leaves	Two forms of starch phosphorylase(A and B)	Polyacrylamide gel electrophoresis and DEAE-cellulose chromatography
Fruit	New bicyclic diaryl heptanoid rel (3S-4Ar,10Br)-8-hydroxy-3-(4-hydroxy phenyl)-9-methoxy-4a,5,6,10b-tetrahydro-3H naphtho (2,1-b) pyran and four known compounds 1,2 dihydro 1,2,3 trihydroxy-9-(4-methoxy phenyl)phenalene (2)-hydroxy anigorufone(3), 2-(4-hydroxy phenyl)naphthalic anhydride(4) and 1,7 bis(4-hydroxy phenyl) hepta-4(E),6(E)-diene-3-one(5)	From ethyl acetate soluble fraction of the methanolic extract of fruits
Peeled fruits	Two new acyl steryl glycosides Sitoindoside-III and Sitosterol myo-inosityl-beta-D-glucoside	Gradient solvent extraction and extensive chromatography(CC,GC,TLC and HPLC)
Fruit pulp	Three forms of $\alpha$ -glucan phosphorylase	Ammonium sulfate fractionation and DEAE- cellulose chromatography
Fruit peels	Trace elements(except Zn)	Ash analysis
Flowers	New tetracyclic triterpine (24R)-4 $\alpha$ -14 $\alpha$ 24-trimethyl-5-cholesta-8,25(27)-dien-3 $\beta$ -ol	
Bracts	Monomeric anthocyanins	
Scape	Watersoluble(WSP),alkali soluble (ASP) and alkali insoluble(AISP) EDTA soluble (EDTA-SP) polysaccharide fractions	
Mucilaginous exudate	Arabinose,xylose and galactouronic acid as major sugars together with traces of galactose, rhamnose, mannose and glucose residues	Anion exchange chromatography

Both extracts when studied for incision and dead space wounds parameters increased wound breaking strength and levels of hydroxyl proline, hexuronic acid, hexosamine, superoxide dismutase, reduced glutathione in the granulation tissue and decreased percentage of wound area, scar area when compared with the control group both the extracts showed good safety profile (Agarwal *et al.*, 2009).

**Antidiabetic activity**

Methanolic extracts of mature green fruit of *Musa Paradisiaca* in normal and Streptozocin treated diabetic mice using Chlorpropamide as antidiabetic agent. MEMP(100-800 mg/kg, p.o) showed significant dose related ( $p < 0.05 - 0.001$ ) reduction in the blood glucose concentration in normal and diabetic mice. Chlorpropamide (250 mg/kg p.o) also produced significant ( $p < 0.01$  and  $p < 0.001$ ) reduction in the blood glucose concentration in normal and diabetic mice. (Ojewole and Adewunmi, 2003).

**Antiuro lithiatic Activity**

The fresh juice of *Musa* stem (*Puttubale*) was tested for its antilithiatic activity. Zinc discs were implanted in the urinary bladder of albino rats to induce urolithiasis. This stones formed was mainly of magnesium ammonium phosphate with traces of calcium oxalate. *Musa* stem juice (3ml rat/day, orally) was found to be effective in reducing the stone formation and also in dissolving the pre-formed stones (Prasad *et al.*, 1993).

**Skeletal Muscle contraction**

An extract obtained from stem juice induces twitch augmentation in skeletal muscles the mechanism of action was investigated in the mouse hemi-diaphragm preparation. Directly evoked twitchings and potassium induced contractures were both augmented by the extract. Twitch augmentation was partly dependent on extracellular  $Ca^{2+}$ . The results are consistent with an action of banana tree juice on the molecule responsible for excitation-contraction coupling in skeletal muscle resulting malabilization of intracellular  $Ca^{2+}$  (Singh and Drydem, 1990).

**Antidote for crotalidae venoms**

Phospholipase  $A_2$ , myotoxic and hemorrhagic activities including lethality in mice induced by crotalidae venoms were significantly inhibited when different amounts of MSE were mixed with these venoms before assays on the other hand mice that received MSE and venoms without previous mixture are by separate routes were not protected against venom toxicity. *Musa sapientum* var. *paradisiaca* extract does not show protection against the toxic effects of snake venoms *in vivo* but it was very effective when the experiment were done *in vitro* ( Brandeburgo and Delima, 2005).

**Direct vascular effects of plantain extract**

Responses of aorta and portal veins isolated from rats to aqueous extract of *Musa Paradisiaca* were studied. The extract produced concentration dependent

relaxation in both NA contracted aortic 54.45± 6.63 % and in KCl contracted rings was 77.5± 2.52 % of the initial tension developed in response to the contractile agents (Agarwal *et al.*, 2009).

#### Miscellaneous Activity

Stem juice has been shown to contain peroxidase activity of the order of 0.1 enzyme unit/ml. At low pH *Musa Paradisiaca* stem juice exhibiting lignin peroxidase type activity. Treatment of of herbal

formulated drug named as MTEC consist of aqueous methanol extract of *Musa Paradisiaca*, *Tamarindus indica*, *Eugenia jambolana* and *Coccinia indica* to Streptozocin induced diabetic rat at the ratio of 2:2:1:1 at the dose of 60mg/day for two times a day for 14 days result in a significant protection in fasting blood glucose and serum insulin levels along with the testicular function towards the control levels(p<0.05)(Mallick *et al.*, 2007).

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