Investigation of Phytochemical Constituents and Some Bioactivities of *Musa paradisiaca*L.Flower

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Abstract

Musa paradisiaca L. is the well-known plant of musaceae family that has been used in traditional medicine. In this research, the flowers of *Musa paradisiaca* L.(banana) were collected to investigate the phytochemical constituents and some bioactivities. The phytochemical test revealed that this banana flower consists of alkaloids, glycosides, organic acids, reducing sugars, tannins, saponins, carbohydrates, ∝ -amino acids, flavonoids, phenolic compounds, polyphenols, steroids and terpenesrespectively. The elemental analysis was done by Energy Dispersive X-ray fluorescence (ED XRF) spectroscopy. According to ED XRF results, potassium was the highest amount in this banana flower. The antimicrobial activities of n-hexane, ethanol and ethyl acetate extracts of flower sample were examined on six microorganisms such as *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Bacillus pumilis, Candida albicans* and *Escherichia coli*. The antioxidant activities of water and ethanol extracts of the flower were determined by DPPH scavenging assay. In this determination, ethanol extract of the flower (IC_{50}=3.64 μg/mL) was found to have comparable antioxidant activity with standard ascorbic acid (IC_{50}=3.24 μg/mL). Moreover, the antitumor activities of water and ethanol extracts of flower sample were also examined by potato disc assay method. Both extracts of flower sample showed the antitumor activity.

Keywords: phytochemical, microorganisms, antioxidant, antitumor

Introduction

Medicinal plants have been used in various traditional medicines.The term “medicinal plant” includes various types of plants used in herbalism. The term “herb” refers to any part of the plant like fruit, seed, stem, bark, flower, leaf, stigma or a root, as well as a non-woody plant. These medicinal plants are also used as food, medicines or perfumes and also in certain spiritual activities. Traditional systems of medicine continue to be widely practiced on many accounts. Population rise, inadequate supply of drugs, prohibitive cost of treatments, side effect of several synthetic drugs and development of resistance to currently used drugs for infectious diseases have led to increase emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments (Zahid, 2016).There is a large amount of experimental evidence which suggests that consumption of fruits and vegetables reduces the risk of cancer (Chen et al., 2004).Phenolic compounds are one of the most abundant and ubiquitous group of plant metabolites, and are an integral part of the human diet. In addition to their primary potent antioxidant activity,this group of compounds display a widely of biological functions, which are mainly related to intervention in various stages of cancer development including initiation,progression, promotion, invasion and metastasis (Ramos,2008).

Musa paradisiaca L.(banana) belonging to Musaceaefamily,is cultivated in all tropical areas native to India and Myanmar.It is considered as the second largest fruit product in the world (Sharma, et al., 2017). The banana flower is rich in

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phytochemicals like vitamins, flavonoids and proteins. The flower has been used to treat bronchitis, constipation and peptic ulcer. The flower extract has antioxidant property that prevents free radicals, and control cell and tissue damage (Bhaskar, et al.,2011).

Therefore, this research was done to investigate the phytochemical constituents and some bioactivities such as antimicrobial, antioxidant activities and antitumor activities of banana flowers.

Botanical Description

Scientific Name -- *Musa paradisiaca* L.

Family Name -- Musaceae

English Name -- Banana

Myanmar Name -- Pheekyanngetpyaw

Figure1.BananaFlower

Figure 2.Banana Plants

Aim

The main aim of this research is to investigatethe phytochemical constituents and some bioactivities of *Musa paradisiaca* L.(Banana) flower.

Objectives

-To collect the banana flowersfrom MyitkyinaTownship, Kachin State.

-To carry out the phytochemical screening of the banana flower sample.

-To analyze the elemental contents of the sample by EDXRF spectroscopy.

-To examine the antimicrobial activities of sample by agar well diffusion method on six micro- organisms.

-To investigate the antioxidant activities of water and ethanol extracts of sample by DPPH scavenging assay.

-To determine the antitumor activities of the water extract and ethanol

extract of flower sample by potato disc assaymethod.

Materials and Methods

Sample Collection and Preparation

Musa paradisiaca L.(Banana)flowers were collected from Myitkyina Township, Kachin State, Myanmar for chemical analysis in January,2019.

After sample collection, the banana flowers were cut into small pieces and dried in air. Then, these dried samples were ground into powder by grinderand stored in air-tight container to prevent moisture changes and contamination.

Phytochemical Screening of Banana Flower(Harbone,1984)

The various solvents extracts of the flower sample were prepared to analyze the presence of certain organic compounds. Analysis was done for alkaloids, glycosides, organic acids, reducing sugars, tannins, saponins, carbohydrates, $\propto$ -aminoacids, flavonoids, phenolic compounds, polyphenols, steroids, terpenes and cyanogenic glycosides.

Analysis on Elemental Contents of Banana Flower

The elemental contents of the flower sample were analyzed by Energy Dispersive X-Ray Fluorescence (EDXRF) spectrophotometer.

Determination of SomeBioactivities of Extracts of Banana Flower

The three solvents such as n-hexane, ethyl acetate and ethanol were used to analyze the antimicrobial activities of the flower sample. The antimicrobial activities of flower sample were analyzed by agar-well diffusion method on six microorganisms such as *Bacillus subtilis, Staphylococcus aureus, Pseudomonas aeruginosa, Bacillus pumilis, Candida albicans* and *Escherichia coli*.

DPPH (1,1-diphenyl-2-picryl-hydrazyl) radical scavenging assay was chosen to assess the antioxidant activities of the flower sample. In this study, water and ethanol extracts of the flower sample were used. TheDPPH radical-scavenging assay measures the ability of the compound to donate hydrogen to DPPH radical. The DPPH radical-scavenging activity of the flower sample was determined based on median inhibition concentration (IC_{50}). In this experiment, ascorbic acid was used as standard antioxidant.

The antitumor activities of ethanol and water extracts of banana flower were screened on *Agrobacterium tumefacien* by Potato Disc Assay method.

Results and Discussion

Phytochemical Constituents of Banana Flower

The phytochemical analysis was performed in order to know different types of organic compounds present in theflower sample. Analysis on the extracts of the flower sample revealed the presence of valuable phytochemicals for human health. These phytochemicals are known to exhibit medicinal as well as physiological activities.The results are shown in Table1.

Table 1.PhytochemicalConstituents of Banana Flower

No.	Constituents	Extract	Reagents	Observation	Result
1.	Alkaloids	1% HCl	Dragendroff's reagent	Orange ppt.	+
2.	Flavonoids	ethanol	Conc: HCl, Mg	Pink color	+
3.	Glycosides	Water	10% lead acetate	White ppt.	+
4.	Organic acids	Water	Bromocresol green	Blue color solution	+
5.	Tannins	Water	10%$FeCl_3$,H_2SO_4	Pale brown ppt.	+

6.	Carbohydrates	Water	10%α-naphthol, Con.H_2SO_4	Red ring	+
7.	α − amino acids	water	Ninhydrin	Violet color	+
8.	Phenolic compounds	Water	1% $FeCl_3$	Purplish color	+
9.	Polyphenols	ethanol	1% $FeCl_3$ + 1% $K_3[Fe(CN)_6]$	Green blue color	+
10.	Saponins	Water	-	Froth	+
11.	Steroids	ethanol	$CHCl_3$,$(CH_3CO)_2O$, H_2SO_4	Green color	+
12.	Terpene	Pet-ether	$CHCl_3$,$(CH_3CO)_2O$, H_2SO_4	Pink color	+
13.	Reducing sugar	Water	Benedict's solution	Brick-red ppt.	+
14.	Cyanogenic glycoside	Water	Con: H_2SO_4, sodium picrate paper	No brick-red color	-

(+) = Presence, (-) = Absence

According to the Table (2),it could be observed that the flowersample contains thevaluable phytochemicals for human health.Cyanogenic glycosides which generally possess toxic property was found to be absent in the flower sample.

Elemental Contents of Banana Flower by EDXRF Spectroscopy

The banana flower sample containsminerals that are important for our body to stay healthy. The elemental composition in the flower sample was examined by EDXRF spectroscopy. The results are shown in Table2.

Table 2. Elemental Contents of Banana Flower

No	Elements	Results (mass %)
1	Potassium	2.350
2	Phosphorus	0.294
3	Calcium	0.255
4	Sulphur	0.211
5	Silicon	0.176
6	Manganese	0.009
7	Iron	0.004
8	Rubidium	0.003
9	Zinc	0.002
10	Copper	0.002

It can be seenthatbanana flower sample is a source of minerals that are necessary for healthy life.

Antimicrobial Activities of Banana Flower

The study of antimicrobial activities of the flower sample was performed by agar-well diffusion method on six microorganisms. The results are tabulated in Table 3.

Table 3.Antimicrobial Activities of BananaFlower

Sample	Solvents	Organisms					
		I	II	III	IV	V	VI
	n-hexane	-	-	-	-	-	-
	EtOAc	20mm	27mm	21mm	20mm	25mm	14mm
	EtOH	12mm	12mm	13mm	12mm	11 mm	14mm

Disc diffusion (mm), Susceptible >21 (+++) ,Intermediate – 17.20 (++),Resistant <16(+),Organisms: I=*Bacillus subtilis,*II=*Staphylococcus aureus,* III=*Pseudomonas aeruginosa,*IV =*Bacillus pumalis,*V= *Candida albicans,*VI=*Escherichia coli*

According to the experimental data, ethyl acetate extract of sample gave rise to high activities on all test microorganismsexcept*Escherichia coli.*

Antioxidant ActivitiesofTwoExtracts of Banana Flower

The antioxidant activity was studied on the water and ethanol extracts of sample by DPPH assay. In this experiment, ascorbic acid was used as a standard antioxidant. On the basis of absorbance values, percent inhibition of ethanol extract in different concentrations was calculated. According to results, it can be seen that as the concentration was increased, the percent of inhibition of oxidation was also increased. The IC_{50} values were determined by using linear regressive excel program. IC_{50} value of water extract of flower sample was 4.99µg/mL.IC_{50} value for ethanol extract of sample (IC_{50} = 3.64µg/mL) was comparable to that of standard ascorbic acid (IC_{50} =3.24µg/mL).Therefore, ethanol extract of plant sample showed significant antioxidant activity. The IC_{50} values were tabulated in Table 4.

Table 4.% Inhibition and IC_{50} Values of Ethanol and WaterExtractsofBanana Flower

Extract	Concentration (µg/mL)	Mean % Inhibition	IC_{50} (µg/mL)
Water extract of sample	0.78	44.98	4.99
	1.56	46.73	
	3.125	48.96	
	6.25	52.98	
	12.5	55.99	
	25	61.42	
	50	70.85	
EtOH extract of sample	0.78	46.98	3.64
	1.56	47.89	

	3.125	49.89	
	6.25	52.05	
	12.5	55.93	
	25	61.37	
	50	70.98	
Standard Ascorbic acid	0.78	46.65	3.24
	1.56	48.64	
	3.125	49.97	
	6.25	52.35	
	12.5	54.98	
	25	63.43	
	50	70.87	

Antitumor Activities of Water and Ethanol Extracts of Banana Flower

The antitumor activities of ethanol and water extracts of banana flower were screened on *Agrobacterium tumefacien* by Potato Disc Assay method as shown in Table 5.

Table 5.Antitumor Activities of Two Extracts of Banana flower

Sample	Solvent	Observation of tumor at day 5			Observation of tumor at day 7		
		0.05g	0.1g	0.15g	0.05g	0.1g	0.15g
Banana Flower	EtOH	−	−	−	−	−	−
	Water	−	−	−	−	−	−
Control		(++)			(++)		

Note: (+) tumor appeared; (−) no tumor appeared

From the experimental results, it could be observed that tumor did not appear at both water and ethanol extracts (0.05g, 0.1g and 0.15g) of banana flower. Therefore, water and ethanol extracts of banana flower prevented tumor activity.

Conclusion

In this research, *Musa paradisiaca* L.(Banana)flowers were collected for chemical analysis. The investigation of phytochemical constituents, elemental contents, antimicrobial activity, antioxidant activity and antitumor activity of banana flower was performed. The phytochemical screening indicated that the flower sample containsthe invaluable phytochemical constituents for human health.These phytochemicals confer antimicrobial activity on the flower extract. From the experimental results, ethyl acetate extract of flower sample was found to be

remarkable antimicrobial activity. Therefore, this extract can be used in medicinal formulation to treat the diseases related to test microorganisms.

According to the elemental analysis, the flower sample contains minerals that are necessary for health benefits. Moreover, antioxidant properties are very important due to the harmful role of free radicals in food and biological systems. The antioxidant activity of the flower extract was evaluated by DPPH method. In the DPPH assay, IC_{50} value of ethanol extract of flower sample was found to be 3.64µg/mL and that of ascorbic acid was 3.24µg/mL.These IC_{50}values were comparable. Thus, the ethanol extract of the flower sample showed the significant antioxidant activity.

According to the experimental results of antitumor activities, both water and ethanol extracts of flower sample prevented the tumor activity. It indicated that banana flower has antitumor activity.

Therefore,thebanana flower could be considered as a source of valuable phytochemicals and minerals that possess the antimicrobial activity, antioxidant activity and antitumor activity for medicinal purposes.

Finally, more detailed research for this banana flower sample should be performed from the pharmacological point of view.

Acknowledgement

I would like to express our heartfelt gratitude to Dr. Than ThanWin ,Professor and Head,Department of Chemistry, Monywa University for her interest and encouragement on this research paper. I deeply thank to Dr. Ni NiAung, Professor and Head, Department of Chemistry, MyitkyinaUniversity for her invaluable advice and encouragement for the research work.

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