Evaluation of Important Parameters of *Ficus racemosa* L.

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Abstract

Ficus racemosa L. is very useful plant and beneficial used for human health especially in Asia. It is locally known as Yea-thapan, belonging to the family Moraceae. The seed of *Ficus racemosa* L. was selected for evaluation of phytochemical constituents, nutritional compositions, elemental analysis and isolation of some organic compounds. The phytochemical constituents was performed using a standard procedure. The phytochemical analysis revealed that alkaloid, flavonoid, glycoside, steroid, polyphenol, phenolic compound, reducing sugar and saponin were present in the sample. Then, nutritional compositions of sample such as moisture, ash, fiber, protein and fat were determined by standard AOAC methods. In the sample the moisture content (11.62 %), the ash content (8.21 %), the fiber content (20.89 %), the protein content (11.54 %) and the fat content (1.38 %) were found to be present. The sample is an excellent source of fiber which helps to constipation condition and reducing blood pressure. The elemental analysis of sample was investigated by Energy Dispersive X-rays Fluorescence (EDXRF) spectral data. The potassium (1.11%) was the highest amount in sample. Moreover, some organic compounds were isolated and purified from ethyl acetate by using Thin layer (TLC) and Colum chromatographic techniques. The prominent functional groups in some organic compounds were assigned by Fourier Transform Infrared (FT-IR) spectroscopy.

Keywords : Nutritional values, phytochemical, EDXRF, isolation, FT-IR

Introduction

Ficus racemosa L. (Moraceae) is an evergreen, moderate to large sized spreading, lactiferous, deciduous tree, without much prominent aerial roots found throughout greater part of India in moist localities and is often cultivated in villages for its edible fruit (Anonymous, 1952). All parts of this plant (leaves, fruits, bark, latex, and sap of the root) are medicinally important in the traditional system of medicine in India. The seeds are tiny, innumerable and grain-like. Outer surface of the bark consists of easily removable translucent flakes grayish to rusty brown, uniformly hard and non- brittle(Chopra RN, *et al*., 1992).The bark is reddish grey or grayish green, soft surface, uneven and often cracked, 0.5-1.8 cm thick, on rubbing white papery flakes come out from the outer surface, inner surface light brown, fracture fibrous, taste mucilaginous without any characteristic odour. Unlike the banyan, it has no aerial roots. Those looking for the flower of goolar should know that the fig is actually a compartment carrying hundreds of flowers.Texture is homogeneously leathery (Warrier, *et al*., 1996). The roots of *F.racemosa* L.are long, brownish in colour. It's having characteristic odour and slightly bitter in taste Roots are irregular in shape (Anonymous , 1966). The seed of these species are important and very effective studies has been reported for phytochemical constituents, nutritional compositions and elemental analysis and their evaluation. This study was undertaken to develop isolation of organic compound and FT-IR fingerprinting of seeds of sample. This may be useful to study their nutritive and elemental analysis in order to prioritize their edibility for indigenous people.

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Materials and Methods

Commercial grade reagents and solvents were used without further purification. EDXRF spectrophotometer (AMETEX, England) was applied to determine the chemical elements in the sample. Silica gel (Merck Co. Inc Kiesel gel 60 F254, 70-230 mesh) was used for Column Chromatography. UV-Lamp (Lambda – 40, Perkin – Elmer Co, England) and iodine vapor were used as developing agents in column chromatography. FT-IR spectrometer (Shimadsu, Japan) was used for the identification of the functional groups of isolated organic compounds.

Sample Collection

The fruits of *Ficus racemosa* L.were collected from Kyaukse Township, Mandalay Region, Mandalay, Myanmar. The fruits were divided into two parts. The inner part of the fruits was air dried at room temperature for throughout the experiment.

Botanical Description

Family Name - Moraceae
Botanical Name - *Ficus racemosa* L.
Local Name - Yea-thapan
English Name - Cluster fig
Part Used - Seeds

Figure 1. The Fruits and Seeds of *Ficus racemosa* L.

Determination of Phytochemical Constituents of Sample

Phytochemical investigation on the extracts of sample was carried out according to standard procedures and the presence of chemical constituents wasidentified and each of test was expressed as negative(-) or positive(+). (Harborne, 1993).

Determination of Nutritional Compositions of Sample

The contents of moisture, ash, protein, fat and fiber were determined by standard method.

Determination of Moisture

The moisture content of samples was determined by oven drying method (Official Methods of Analysis, AOAC, 1999).

Determination of Ash

The ash content of samples was determined by oven drying method (Official Methods of Analysis, AOAC, 1999).

Determination of Protein

The protein contents of samples was determined by using Kjeldahl's method (Official Methods of Analysis, AOAC, 1999) method with nitrogen estimation system using the conversion factor of N × 6.25.

Determination of Fat

The fat content of samples was determined by Soxhlet extraction method (Official Methods of Analysis, AOAC, 1999).

Determination of Fiber

The fiber content of samples was determined by gravimetric method. (Forage Fiber Analysis, 1970)

Determination of Elemental Analysis of Sample

The elemental composition of sample was examined by the Energy Dispersive X-ray Fluorescence (EDXRF) spectrophotometer at Department of Chemistry, Monywa University. (SPECTRO XEPOS EDXRF Spectrometer, Germany)

Extraction and Isolation of Organic Compounds from Sample

The sample 300 g was percolated with 95% ethanol 1500 mL for about two months and then filtered and the filtrate was concentrated. The residue was re-extracted with 300 mL of ethyl acetate (EtOAc) and checked by TLC. The EtOAc extract (2.85 g) was separated by column chromatography using silica gel and eluent as n-hexane and ethyl acetate. The pure compound I (pale yellow oil form), compound II (yellow oil form) and compound III (deep yellow oil form) were obtained. The R_f value of pure compound I is 0.50 (n-hexane:ethylacetate 2:3 v/v), pure compound II is 0.42 (n-hexane: ethylacetate 1:1 v/v) and pure compound III is 0.52 (n-hexane: ethylacetate 3:2 v/v).

FT-IR Analysis of Organic Compounds

The Fourier Transform Infrared spectrum of compound I, compound II and compound III were measured at Department of Chemistry, Monywa University. The FT-IR spectrum informs the prominent functional groups containing the compounds I, II and III were described in Figure.

Results and Discussion

Phytochemical Constituents of Sample

Phytochemical test wascarried out to detect the presence of organic constituents in the seeds of F*icus racemosa* L. The sample were extracted with various solvents such as 1%HCl, 95% Ethanol and distilled water.

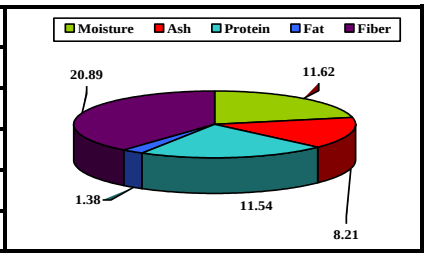
According to the phytochemical result, the seeds of *Ficus racemosa* L. extract consists of alkaloid, flavonoid, glycoside, steroid, polyphenol, phenolic compound, reducing sugar and saponin respectively. There was a pale orange precipitate formation in the test tubes and reddish brown precipitate formation in the test tubes after treating with Dragendorff's Reagent and Wagner's Reagent thus indicates the presence of alkaloid in the plant extract. The yellow colour was formed in the test tubes after treating with diluted hydrochloride acid and Mg turning thus indicated the presence of flavonoid. Glycoside was formed in the test tubes after treating with10% lead acetate. The steroid was present in the plant extract as there was green colour formation in the test tubes after treating with chloroform, acetic anhydride and concentrated Sulphuric acid. Polyphenol and phenolic were formed in the test tubes after treating with1% K_3 [Fe $(CN)_3$] and10% $FeCl_3$. The reducing sugar was present in the plant extract as there was brick red colour formation in the test and concentrated sulphuric acid. Saponin present in seed extract shows that they can be used as lipid lowering agent as well as has anthelmentic and antibacterial activity.

Nutritional Compositions of Sample

Nutritional composition of *Ficus racemosa* L. was investigated by standard methods. The observed datas are tabulated in Table (1).

Table 1. Results of Nutritional Compositions of Seeds of *Ficus racemosa* L.

Nutrients	Results (%)
Moisture	11.62
Ash	8.21
Protein	11.54
Fat	1.38
Fiber	20.89



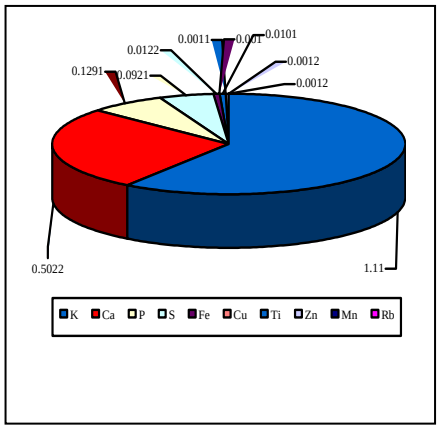
The moisture content of sample was determined and the result was found to be 11.62%in sample. A small change in seed moisture content has a large effect on the storage life of the seeds. Therefore it is important to know the moisture content in order to make a reasonably accurate prediction of the possible storage life of each accession.The ash content of samples was measured and the result was found to be 8.21 % in sample. Some minerals are essential to a healthy diet (*e.g.*, calcium, phosphorous, potassium and sodium) whereas others can be toxic (*e.g.*, lead, mercury, cadmium and aluminum). The protein content of samples was measured and the protein content of sample was found to be 11.54 %. The fat content of sample was measured and the resulting data were found to be 1.38 in sample.The fibre contents of sample was measured and the resulting data was found to be 20.89 % in sample.

Elemental Compositions of Sample

The elemental compositions of seeds of *Ficus racemosa* L. was determined and the results were show in Table (2).

Table 2. Elemental Composition of Sample

Symbol	Element	Amount Concentration
K	Potassium	1.1100%
Ca	Calcium	0.5022%
P	Phosphorous	0.1291%
S	Sulfur	0.0921%
Fe	Iron	0.0122%
Cu	Copper	0.0010%
Ti	Titanium	0.0101%
Zn	Zinc	0.0011%
Mn	Manganese	0.0012%
Rb	Rubidium	0.0012%
Sr	Strontium	0.0013%



From the above data, the mineral composition of the seeds was shown in Table (2). It was observed that potassium was the most abundant mineral in sample. The seeds were good source of calcium and phosphorous. The trace elements such as sulfur, iron, copper, titanium, zinc, manganese, rubidium and strontium were detected. The seed is edidable for people.

Thin- Layer Chromatography of Pure Compound I, II and III

The isolated organic compound I, II and III were checked by TLC (using n hexane : ethyl acetate (2:3, v/v), (1:1, v/v) and (3:2/ v/v) iodine developer. The R_f values of these three organic compound were determined. The R_f values of compound I, II and III are 0.50, 0.42 and 0.52.

Compound I	**Compound II**	**Compound III**
Solvent system = n-hexane :EtOAc (2:3, v/v)	Solvent system=n-hexane : EtOAc (1:1,v/v)	Solvent system = n-hexane :EtOAc (3:2, v/v)
Developer =Uv and Iodine	Developer = UV and Iodine	Developer = Uv and Iodine
Adsorbent=Silica-gelplate	Adsorbent = Silica-gel plate	Adsorbent=Silica-gelplate
R_F value of Compound I =0.50	R_F value of Compound II = 0. 42	R_F value of Compound III = 0.52

FT-IR Assignment of Isolated Compound (I), (II) and (III)

In the FT-IR spectrum of compound (1), the peaks at 2924.50 and 2854.25 cm^{-1} are due to the asymmetric and symmetric C-H stretching vibrations of sp^3 hydrocarbons. The band at 1710.40 cm^{-1} indicates the C=O stretching vibration of carbonyl group. The bands which occur at 1461.34 cm^{-1} should be the C-H in plane bending vibration of sp^3 hydrocarbons. The C-O stretching vibration of alcohol group was observed at 1376.68 and 1244.06 cm^{-1}. Finally, the bands at 784.36 cm^{-1} and 761.11 cm^{-1} represent the $=CH^2$ wagging vibration of exo-methylene group. According to the IR spectrum in Figure (2), the compound (1) contains the sp^3 hydrocarbon and carbonyl functional groups.

In the FT-IR spectrum of compound (1), the peaks at 2923.42 and 2852.91 cm^{-1} are due to the asymmetric and symmetric C-H stretching vibrations of sp^3 hydrocarbons. The band at 1712.01 cm^{-1} indicates the C=O stretching vibration of carbonyl group. The bands which occur at 1652.92 cm^{-1} should be the C-H in plane bending vibration of sp^3 hydrocarbons. The C-O stretching vibration of alcohol group was observed at 1456.03 and 1376.85 cm^{-1}. The bands appeared at 1245.68 and 1172.80 cm^{-1} should be C–C–O stretching vibration of ester group. Finally, the bands at 784.35 cm^{-1} and 761.07 cm^{-1} represent the $=CH_2$ wagging vibration of exo-methylene group. According to the IR spectrum in Figure (3), the compound (2) contains the sp^3 hydrocarbon and carbonyl functional groups.

The band at 3382.24 cm^{-1} indicates the O-H stretching vibration of alcohol group. The peaks at 2923.20 cm^{-1} and 2853.10 cm^{-1} should be asymmetric and symmetric C-H stretching vibration of sp^3 hydrocarbons. The band at 1715.10 cm^{-1} indicates the C=O stretching vibration of carbonyl group. The bands at 1171.43 cm^{-1} and 1047.04 cm^{-1} should be C–C–O stretching vibration of ester group. The bands which occur at 1456.19 cm^{-1} and 1376.37 cm^{-1} representing the C-H bending vibration of methyl groups. Finally the bands at 784.17 cm^{-1} and 762.92 cm^{-1} represent the $=CH^2$ wagging vibration of exo-methylene group. According to the IR spectrum in Figure (4), the compound (III) shows the presence of –OH functional groups, sp^2 hydrocarbons, ether and Z- or cis- alkene groups.

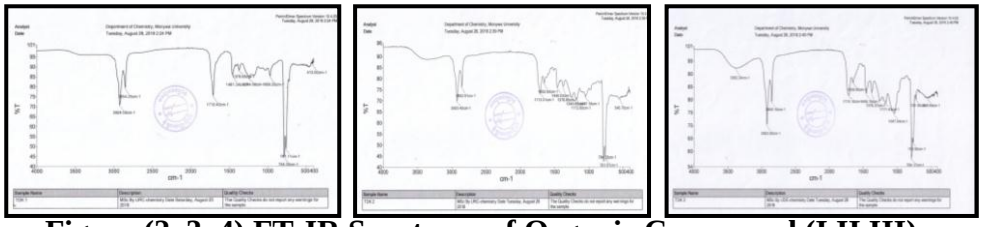


Figure (2, 3, 4) FT-IR Spectrum of Organic Compound (I,II,III)

Conclusion

The phytochemical analysis showed that the the crude extract of seeds of *Ficus racemosa* L. contains a mixture of phytochemicals such as alkaloid, flavonoid, glycoside, steroid, polyphenol, phenolic, reducing sugar and saponin. The mineral composition of the seeds was shown in Table. It was observed that potassium was the most abundant mineral in sample. The seeds was a good source of calcium and phosphorous.The trace elements such as sulfur, iron, copper, titanium, zinc, manganese, rubidium and strontium were detected. High mineral contents are sometimes used to retard the growth of certain microorganisms. The quality of many nutritional values depends on the concentration and type of minerals they contain, including their taste, appearance, texture and stability.

The yield percent of Compound I, Compound II and Compound III were observed as 0.0038%, 0.0026 % and 0.025%. The R_f values of these three organic compound were determined. The R_F values of compound I, II and III are 0.50, 0.42 and 0.52 respectively. The functional groups determinations of the compounds I, compound II and compound III were done by FT- IR spectral data. Compounds I contain the sp^3 hydrocarbon and carbonyl functional groups. Compound II contains the sp^3 hydrocarbon and carbonyl functional groups. Compound III contain shows the presence of –OH functional groups, sp^2 hydrocarbons, ether and Z- or cis-alkene groups. Especially, in compound I, compound II and compound III contains the same $=CH_2$ wagging vibration of exo-methylene group. It can be used for the purpose of medicinal and beneficial to man-kind.

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