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PHARMACOLOGICAL INVESTIGATIONS ON DIFFERENT PARTS OF *SOLANUM MELONGENA*

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ABSTRACT

In present study an attempt was made to study the phytochemical, and Pharmacological activities of different extracts and isolated compounds of *Solanum melongena*. The dried root, stem, leaf, aerial part and fruits were powdered and successively extracted by different solvents like pet ether, chloroform, ethyl acetate, ethanol and water. Different extracts of *Solanum melongena* were evaluated for 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity. Ascorbic acid was used as reference standard. Average percentage inhibition, IC50 values, Total phenolic content and Total flavonoids were recorded for Ethyl acetate, ethanolic and aqueous extract of root, stem, leaves, aerial parts and fruits. All the extracts exhibited strong antioxidant activity with low IC50 values. Total phenolic content of ethyl acetate, ethanolic and aqueous extracts of root and leaves showed higher values and total flavonoid content of ethyl acetate, ethanolic and aqueous extracts of roots was found to be the highest. Anti-microbial screening of extracts and isolated compounds showed that Pet ether, methanol, and aqueous extract showed significant antibacterial activity against two gram positive and two gram negative bacteria. The antibacterial activity of the extracts were tested in vitro using *Staphlococcus aureus, Escherchia coli, Pseudomonas aeruginosa and Basillus*.

INTRODUCTION

The search in new medicine form natural origin for the anticipation and cure of diseases of people, including diabetes, has been more and more intensified. Vegetables and fruits are important for proper balance of nutrition and electrolytes in the human body. Both have received an attention in recent years due to their commanding medicinal properties. Polyphenols of fruits and vegetables are responsible for antioxidant properties. Many researchers have confirmed that utilization of fruits and vegetables rich of polyphenols is related to a reduced risk of diseases related to heart, nerve, muscles and digestion. [1– 3].

Brinjal (*Solanum melongena* L.) is an important solaneceous crop of tropics and subtropics. Brinjal fruit (unripe) is primarily consumed as cooked vegetable.

In addition, it has some medicinal uses like antihaemorrhoidal and hypotensive effect and used as an antidote to uspoisono mushrooms. It contains minerals vitamins, water soluble sugars, free reducing sugars, Steroidal glycoalkaloids and proteins. Its antiallergic, anticancer, hypolipidemic, hepatoprotective, activity of various parts of plants is reported [4-11]. Different phytoconstituents present in the various parts are responsible for activity. The extent and superiority of Phytoconstituents present in root, stem, leaf, fruit and aerial parts may be considerably influenced by various factors like region of cultivation, environment, soil type, growing, storage conditions and extraction. Although a lot of research are conducted on the various aspects of *Solanum melongena* but one few have worked on the all

parts of plant hence present work is carried out to investigate pharmacological activity of all parts of plant.

MATERIALS AND METHODS

Anti microbial activity of the extracts and the isolated compounds: Antibacterial activities of different extracts and isolated compounds were tested by the disc-diffusion method.

Preparation of extracts: Plant extracts were prepared by successive solvent extraction method. The dried plant materials (Root, leaves, stem, aerial part and fruits) were powdered and extracted successively with different solvents (non-polar to polar). The plant extracts were filtered through Whatman No. 1 filter paper into beaker. The filtrates were dried until a constant dry weight of each extracts was obtained. The residues were stored at 4°C for further use.

Test Organisms: The pure cultures of bacteria maintained in the AND College of Pharmacy, Babhanan were used for the microbiological work. The test organisms were maintained on Nutrient agar medium and Saborauld's dextrose agar medium. The test organisms were used are tabulated below:

Test Organisms: The antibacterial activity of the extracts were tested in vitro using *Staphlococcus aureus, Escherchia coli, Pseudomonas aeruginosa* and *Basillus* collected from department of microbiology, ANDCP, Babhnan, Gonda, U.P. The growth Medias used were nutrient agar and nutrient broth.

Preparation of inoculums[14] Stock cultures were maintained at 4°C on slopes of nutrient agar. Active cultures for experiments were prepared by transferring a loopful of microorganism from the stock cultures to test tubes of nutrient broth, and incubated for 24 hrs at 37°C. The cultures were diluted with fresh nutrient broth.

Preparation of Media

The medium was prepared by dissolving the different ingredients in water and autoclaved at 121^0C for 15 minutes. This was used for preliminary antibacterial studies.

Antibacterial activity[15-16] *In vitro* antibacterial activity was screened by disc diffusion method using nutrient agar (NA) made from Himedia (Mumbai). The different extracts were loaded on different 3mm sterile disc till saturation. The discs were allowed to diffuse solvents for 5 minutes. The loaded disc was placed on the surface of medium containing microorganisms and the plates were kept for incubation at 37°C for 24 hrs in an incubator. At the end of incubation, zone of inhibition formed around the disc were measured with transparent ruler in millimeter. These studies were performed in triplicate by using standard drugs (10 mcg/disc Penicillin).

Minimum Inhibitory Concentration by Serial Dilution technique[17]

Testing was done in seeded broth containing 106 to 107 colonies forming units per ml (Cfu/ml). The crude extracts were taken at different concentrations ranging from 1000, 500, 250, 125, 62.5, 31.25 µg/ml to determine MIC by using seeded broth as diluents. Similarly, standard penicillin preparations were formulated at same concentrations as used in plant extracts**.** DMSO was used as solvent system for the extracts and standard drug in the experiment. The study involved a series of six assay tubes for the test compounds against each strain. In the first assay tube, 1.8 ml of seeds broth was transferred and 0.2 ml of test solution was added and mixed thoroughly to obtain a concentration of 1000 µg/ml for the extracts. To the remaining five assay tubes, 1 ml of seeded broth was transferred and then from the first assay tube, 1 ml content was pipetted out into the second assay tube and this was mixed thoroughly. This type of dilution was repeated up to 6th assay tube serially. The same procedure was followed for standard drugs. All these experimental procedures were carried out under absolute aseptic conditions. The experiments were done in triplicate. The assay tubes were then incubated at 37 ± 1°C and resultant turbidities were measured using turbidity meter and MIC was calculated. Solvent controls were also observed for inhibitory action**.** DMSO did not show any inhibition. For crude extract and fractions, an MIC below 100 µg/mL was considered as an excellent effect, 100 to 500 µg/mL as moderate, 500 to 1000 µg/mL as weak and over 1000 µg/mL as inactive.

4.10.3 Antimicrobial susceptibility test

The disc diffusion method was used to screen the antimicrobial activity. In vitro antimicrobial activity was screened by using Nutrient agar (NA) obtained from Himedia (Mumbai). The NA plates were prepared by pouring 15 ml of molten media into sterile petriplates. The plates were allowed to solidify and 0.1 % inoculum suspension was swabbed uniformly and the inoculum was allowed to dry for 5 minutes. The different extracts were loaded on 3mm sterile disc till saturation. The loaded disc was placed on the surface of medium and the compound was allowed to diffuse for 5 minutes and the plates were kept for incubation at 37°C for 24 hrs. At the end of incubation, inhibition zones formed around the disc were measured with transparent ruler in millimeter. The same procedure was followed by using Saborauld's dextrose agar plates for the fungus also. These studies were performed in triplicate by using standard drugs (10 µg/disc Penicillin; for bacteria)

Scavenging activity against 1,1-diphenyl-2-picrylhydrazyl radicals and IC 50 value:

2.2.2.1. Preparation of the different extracts of plant materials

Extraction of shade dried powdered plant materials (100g) were carried out. Dried plant materials like rhizome, shoot, leaves and pollen were coarsely powdered and subjected separately to successive solvent extraction by a process of continuous extraction (soxhlation). The extraction was done with different solvents in their increasing order of polarity such as petroleum ether, chloroform, ethyl acetate, methanol. Each time the marc was dried and later extracted with other solvents. All the extract were concentrated by distilling the solvent in a rotary vacuum evaporator and evaporated to dryness and stored in desiccators. The dried extract was weighed and dissolved in respective solvents and stored in cold temperature for further use. For each extract, the yield was calculated in percentage on the basis of dry weight of the whole herbs used (100 g) and the quantity of dry mass obtained after extraction (w/w).

2.2.2.2. Preparation of the water extracts of plant materials

Dried whole herbs (100 g for each sample) were boiled with 1L distilled water for 1 hour. Filtration and collection of the extracts were done three times. The resulting decoction was evaporated to 10 mL and dried in vacuum at 50°C. The dried extract was weighed and dissolved in distilled water and stored in cold temperature for further use. For each extract, the yield was calculated in percentage on the basis of the dry weight of the whole herbs used (100 g) and the quantity of dry mass obtained after extraction (w/w).

2.2.3. Qualitative chemical test in the different extracts [12]

Qualitative chemical test in the different extracts of *Solanum melongena* were carried out as par the method given in Shukla R et al., (2013). Dried extracts were dissolved in the respective solvents and were examined for their chemical constituents separately. Tests were carried out three time and results were tabulated.

2.2.3. Determination of total phenolic content and flavonoid content

The total phenolic content was determined according to the method described by Siddhuraju and Becker [13] Ragazzi and Veronese (1973) and the results were expressed as catechin equivalents. Total flavonoid in different extracts were estimated as rutin equivalent according to the method of Zhishen et al [14].

2.2.3.1. Determination of total phenolic content

20 µL of each extract (125 µg/mL) was added to 200 µL distilled water and 40 µL of Folin-Ciocalteu reagent. The mixture was allowed to stand at room temperature for 5 min and then 40 µL of 20 % sodium carbonate was added to the mixture. The resulting blue complex was then measured at 680 nm. Catechin was used as a standard for the calibration curve. The polyphenol content was calibrated using the linear equation based on the calibration curve. The total polyphenol content was expressed as mg catechin equivalent/g dry weight. The dry weight indicated was the sample dry weight.

2.2.3.2. Determination of total flavonoid content

Aliquots of 1.5 mL extracts were each added to an equal volume of 2% $AlCl_3 \cdot 6H_2O$ (2g in 100 mL methanol) solution. The mixture was vigorously shaken, and the absorbance was read after 10 min of incubation at 430 nm.

Rutin was used as the standard for the calibration curve. The total flavonoid content was calibrated using the linear equation based on the calibration curve. The total flavonoid content was expressed as mg rutin equivalent/g dry weight. The dry weight indicated was the sample dry weight.

2.2.4. Determination of antioxidant activity by DPPH radical scavenging ability [15]

Aliquot (20 µL) of crude extracts at various concentrations were each mixed with 100 mM Tris-HCl buffer (80 µL, pH 7.4) and then with 100 µL of DPPH in ethanol to a final concentration of 250 µM. The mixture was shaken vigorously and left to stand at room temperature for 20 min in the dark. The absorbance of the reaction solution was measured spectrophotometrically at 517 nm. The percentage of DPPH decolorization of the samples was calculated according to the equation: % decolorization = [1- (ABS sample /ABS control)] ×100. IC50 value was the effective concentration at which DPPH radicals were scavenged by 50% and was obtained by interpolation from linear regression analysis. A lower IC50 value indicated a greater antioxidant activity.

Statistical analysis

Experimental results were presented as the mean ± standard deviation (SD) of three parallel measurements. The difference was considered to be statistically significant when the p value was less than 0.05.However, the quantity of phenols and flavonoids found in the wetland medicinal plant extracts were found not to be directly related to their antioxidant activities. But, the additive roles of phytochemicals might contribute significantly to the potent antioxidant activity. Hence, some wetland medicinal plants could be used as an easily accessible source of natural antioxidants in pharmaceutical and medical industries. For this reason, further work should be performed to isolate and identify the antioxidative components of wetland medicinal plants.

RESULTS AND DISCUSSION

In present study an attempt was made to study the phytochemical, and Pharmacological activities of different extracts and isolated compounds of *Solanum melongena*. The pharmacognostic study included T.S of leaf and stem part, powder microscopy, to know the diagnostic characters of leaf and stem. The leaf constants such has stomatal number and index, vein islet number, vein termination and palisade ratio were determined. The proximate values such as moisture content, ash value, extractive value, were carried out. The dried root, stem, leaf aerial part and fruits were powdered and successively extracted by different solvents like pet ether, chloroform, ethyl acetate, ethanol and water starting from non-polar to polar solvent. All the successive extracts were subjected to phytochemical screening. The various extracts were subjected for the isolation of phytoconstituents by TLC, general partition and column chromatography respectively. Qualitative chemical test for different extracts of *Solanum melongena* were carried out and the tests have shown the presence of alkaloids, sterols, sugars, flavonoids and phenols in different fractions of root, leaf, stem, aerial part and fruits. Different extracts of *Solanum melongena* were evaluated for 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity. Ascorbic acid was used as reference standard. Average percentage inhibition for Ethyl acetate extract 76.54, 60.05, 64.43, 74.82 and 68.96; ethanolic extract were 36.88, 38.41,33.57, 61.71 and 42.19; aqueous extract 73.79, 46.66, 56.42, 56.42, 77.39 and 69.79 for Root, stem, leaves aerial parts, and fruits respectively with reference to ascorbic acid 100 (Table 7). The extracts exhibited strong antioxidant activity with IC50 values of Ethyl acetate extract 15.06, 62.06, 53.31, 19.7 and 64.27; ethanolic extract were 23.63, 34.73, 29.25, 15.34 and 52.17; aqueous extract 47.52, 72.36, 37.35, 16.37, and 73.24 for Root, stem, leaves aerial parts, and fruits respectively with reference to ascorbic acid 3.58 µg/ml. Total phenolic content for Ethyl acetate extract were 125.72, 63.73, 84.36, 126.21 and 78.34; ethanolic extract were 108.53, 74.36, 86.47, 115.27 and 93.14; aqueous extract were 134.74, 74.24, 156.16, 117.42 and 146.52 for root, stem, leaves, aerial parts and fruits respectively. Total flavonoids for Ethyl acetate extract were 26.04, 13.47, 31.59, 54.15 and 38. 46; ethanolic extract were 76.41, 69.25, 25.35, 62.76and 43.26; aqueous extract were 47.42, 25.07, 35.30, 51.73 and 36.07 for root, stem,

leaves, aerial parts and fruits respectively. Tests have shown the high percentage of alkaloids, sterols, sugars, flavonoids and tannins in different extracts of root, leaf, stem, aerial part and fruits. Ethyl acetate and aqueous extracts showed higher extractive values. All the extracts exhibited strong antioxidant activity with low IC50 values. Total phenolic content of ethyl acetate, ethanolic and aqueous extracts of root and leaves showed higher values and total flavonoid content of ethyl acetate, ethanolic and aqueous extracts of pollen was found to be the highest. Various extract was subjected to partition with ethyl acetate; the aqueous fraction was then subjected to general separation method.The isolated compounds were characterized by NMR, FTIR, LC-MS, and UV-analysis. Based on these spectral analysis the isolated compounds were identified as flavonoids, sterols, β sitosterol, Phenolic compound, Sugars, Ascorbic acid, Oxalic acid, Solasodine, catechol, alkaloids, saponins.

Antimicrobial activity of extracts of *Solanum melongena.*

The extracts were subjected to Antibacterial activity using different micro organisms (*Bacillus subtilis*, *Staphylococcus aureus*; *Pseudomonas aeruginosa* and *Escherichia coli*) Out of all extracts tested, ethanol extracts were effective against all the four microorganisms.

The root, leaf, stem, aerial part and fruits of *Solanum melongena* were studied for qualitative chemical test, extractive value, total phenol and flavonoid. Free radical scavenging activity and IC 50 were calculated and tabulated. The results have been shown in table.

Table no 1: Zone of inhibition of different extracts of *Solanum melongena* in mm.

S.N.	Zone of inhibition of different extracts in mm							
	Plant Part	Microorganisms	Pet.Extract	Chlo.Extract	Eth.Ac extract	Ethanol.Extract	Aq. Extract	STD Penicillin
1	Root	E.coli	1	5	6	4	7	10
2		P. aureginosa	5	4	2	7	8	
3		S. aeurus	3	3	0	3	4	
4		Bacillus.	1	0	6	7	9	
5	Stem	E.coli	0	1	3	5	5	
6		P. aureginosa	3	2	0	0	6	
7		S. aeurus	5	2	6	6	3	
8		Bacillus.	2	1	6	3	5	
9	Leaf	E.coli	0	4	3	7	2	
10		P. aureginosa	2	6	0	3	2	
11		S. aeurus	3	5	4	7	6	
12		Bacillus.	3	7	0	4	5	
13	Aerial parts	E.coli	5	4	1	5	7	
14		P. aureginosa	2	6	6	4	5	
15		S. aeurus	3	7	5	0	7	
16		Bacillus.	4	0	7	4	0	
17	Fruits	E.coli	3	2	4	6	4	10
18		P. aureginosa	0	1	0	6	7	
19		S. aeurus	2	6	3	8	4	
20		Bacillus.	4	2	0	3	7	

Scavenging activity against 1,1-diphenyl-2-picrylhydrazyl radicals and IC 50 value:

Different extracts of *Solanum melongena* were evaluated for 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity. Ascorbic acid was used as reference standard. The percentage inhibition of different concentrations has been tabulated in table 3-6 & figure 3-6. Average percentage inhibition for Ethyl acetate extract 76.54, 60.05, 64.43, 74.82 and 68.96; ethanolic extract were 36.88, 38.41,33.57, 61.71 and 42.19; aqueous extract 73.79, 46.66, 56.42, 56.42, 77.39 and 69.79 for Root, stem, leaves aerial parts, and fruits respectively with reference to ascorbic acid 100 (Table 7). The extracts exhibited strong antioxidant activity with IC50 values of Ethyl acetate extract 15.06, 62.06, 53.31, 19.7 and 64.27; ethanolic extract were 23.63, 34.73, 29.25, 15.34 and 52.17; aqueous extract 47.52, 72.36, 37.35, 16.37, and 73.24 for Root, stem, leaves aerial parts, and fruits respectively with reference to ascorbic acid 3.58 µg/ml. (Table 8)

Total phenolic content

Total phenolic content for Ethyl acetate extract were 125.72, 63.73, 84.36, 126.21 and 78.34; ethanolic extract were 108.53, 74.36, 86.47, 115.27 and 93.14; aqueous extract were 134.74, 74.24, 156.16, 117.42 and 146.52 for root, stem, leaves, aerial parts and fruits respectively.

Total flavonoids:

Total flavonoids Ethyl acetate extract were 26.04, 13.47, 31.59, 54.15 and 38. 46; ethanolic extract were 76.41, 69.25, 25.35, 62.76and 43.26; aqueous extract were 47.42, 25.07, 35.30, 51.73and 36.07 for root, stem, leaves, aerial parts and fruits respectively.

Table no 2:Minimum Inhibitory Concentration of different extracts of *Solanum melongena* in µg/ml.

S.N.	Minimum Inhibitory Concentration of different extracts in µg/ml							
	Plant Part	**Microorganisms**	**Pet ether.Extact**	**Chlo. Extact**	**Eth.Ac Extact**	**Ethanol. Extact**	**Aq. Extact**	**STD Penicillin**
1	Root	E.coli	1000	125	125	250	125	31.25
2		P. aureginosa	125	250	500	125	62.5	
3		S. aeurus	250	250	ND	250	250	
4		Bacillus.	1000	ND0	125	125	31.25	
5	Stem	E.coli	ND	1000	250	125	125	
6		P. aureginosa	250	500	ND	ND	125	
7		S. aeurus	125	500	125	125	250	
8		Bacillus.	500	ND	125	250	125	
9	Leaf	E.coli	ND	250	250	125	500	
10		P. aureginosa	500	125	ND	125	500	
11		S. aeurus	500	125	250	125	125	
12		Bacillus.	250	125	ND	250	125	
13	Aerial parts	E.coli	125	250	1000	125	125	
14		P. aureginosa	500	125	125	250	125	
15		S. aeurus	500	125	125	ND	125	
16		Bacillus.	125	ND	125	250	ND	
17	Fruits	E.coli	500	500	250	125	250	31.25
18		P. aureginosa	ND	1000	ND	125	125	
19		S. aeurus	500	125	250	62.5	125	
20		Bacillus.	125	500	ND	500	125	

Where *E.c= E.coli P.a= P.aureginosa S.a= S.aureus B.= Bacillus*, nd : not determined as the MIC was >1000 µg/ml.
Pet.Ex= Petroleum ether extract, Chlo.E= Chloroform extract, Eth.Ac= Ethyl acetate, Alco.E= Alcoholic extract, Aq.E=Aqueous Extract, STD=Standard (Penicillin)

Table No 3: Percentage inhibition of different extracts of Root.

S.N.	Concentration used	Percentage inhibition of ethyl acetate extract	Percentage inhibition of ethanolic extract	Percentage inhibition of Aqueous extract
1	500	96.21	68.38	87.23
2	250	94.15	59.19	84.09
3	125	91.22	51.36	82.14
4	62.5	88.47	47.27	80.09
5	31.25	81.40	36.21	78.17
6	15.6	78.56	29.13	73.52
7	7.8	67.34	20.09	69.46
8	3.9	53.27	11.15	59.67
9	1.95	38.26	9.18	49.74

Table No 4:Percentage inhibition of different extracts of Stem.

S.No	Concentration used	Percentage inhibition of ethyl acetate extract	Percentage inhibition of ethanolic extract	Percentage inhibition of Aqueous extract
1	500	89.34	63.57	77.29
2	250	80.11	57.77	62.78
3	125	76.54	49.84	59.62
4	62.5	71.17	43.61	52.43
5	31.25	62.83	39.17	47.18
6	15.6	58.67	32.93	42.06
7	7.8	40.73	26.15	33.73
8	3.9	34.62	21.35	26.67
9	1.95	26.45	11.37	18.23

Table No 5: Percentage inhibition of different extracts of leaf.

S.N.	Concentration used	Percentage inhibition of ethyl acetate extract	Percentage inhibition of ethanolic extract	Percentage inhibition of Aqueous extract
1	500	94.83	66.09	88.16
2	250	86.71	52.29	75.34
3	125	81.27	48.31	68.13
4	62.5	79.35	37.18	62.29
5	31.25	67.33	31.57	57.78
6	15.6	58.13	28.67	52.55
7	7.8	46.69	18.11	40.39
8	3.9	39.44	11.28	39.62
9	1.95	26.16	8.64	23.53

Table No 6:. Percentage inhibition of different extracts of aerial parts.

S.N.	Concentration used	Percentage Inhibition of ethyl acetate extract	Percentage Inhibition of ethanolic extract	Percentage Inhibition of Aqueous extract
1	500	94.21	84.68	98.58
2	250	89.74	78.19	96.73
3	125	85.68	75.36	92.41
4	62.5	79.81	69.87	89.36
5	31.25	74.14	61.52	81.74
6	15.6	69.72	57.27	74.64
7	7.8	76.62	48.35	66.32
8	3.9	58.55	46.66	54.13
9	1.95	44.94	33.57	42.65

Table No 7:. Percentage inhibition of different extracts of fruits.

S.N.	Concentration used	Percentage Inhibition of ethyl acetate extract	Percentage Inhibition of ethanolic extract	Percentage Inhibition of Aqueous extract
1	500	95.83	76.68	98.16
2	250	91.11	62.49	95.64
3	125	89.57	58.36	88.73
4	62.5	71.45	47.22	72.69
5	31.25	69.31	41.17	67.38
6	15.6	61.23	38.27	62.35
7	7.8	56.62	24.61	59.89
8	3.9	49.14	19.36	49.62
9	1.95	36.43	11.59	33.73

Table No 8: Average percentage inhibition of different extracts of *Solanum melongena.*

S. No.	Plant Part	Ethyl acetate extract	Ethanolic extract	Aqueous extract	Standard Ascorbic acid
1	Root	76.54	36.88	73.79	100
2	Stem	60.05	38.41	46.66	100
3	Leaves	64.43	33.57	56.42	100
4	Aerial parts	74.82	61.71	77.39	100
5.	Fruit	68.96	42.19	69.79	100

Table No 9:IC $_{50}$values of different plant parts in various solvents (µg/ml)

S.N.	Plant Part	IC $_{50}$ of Ethyl acetate extract	IC $_{50}$ of ethanolic extract	IC $_{50}$ of Aqueous extract	IC $_{50}$ of standard ascorbic acid
1	Root	15.06	23.63	47.52	3.58
2	Stem	62.06	34.73	72.36	
3	Leaves	53.31	29.25	37.35	
4	Aerial parts	19.7	15.34	16.37	
5.	Fruit	64.27	52.17	73.24	

Total No 10:Phenolic content in mg catechin equivalent/g dry weight (µg CE/mg).

S. No.	Plant Part	Ethyl acetate extract	Ethanolic extract	Aqueous extract
1	Root	125.72 ± 0.17	108.53±0.27	134.74 ± 0.58
2	Stem	63.73 ± 0.11	74.36 ± 0.19	74.24 ± 0.43
3	Leaves	84.36 ± 0.20	86.47 ± 1.58	156.16 ± 0.72
4	Aerial parts	126.21 ±0.15	115.27 ± 1.26	117.42±2.52
5	Fruits	78.34±0.18	93.14±0.06	146.52 ± 0.82

Values represented mean ± S.D. of three parallel measurements.

Table No 10: Total Flavonoid in mg rutin equivalent/g dry weight (µRE/mg).

\S. No.	Plant Part	Ethyl acetate extract	**Ethanolic extract**	**Aqueous extract**
1	Root	26.04 ± 0.07	76.41 ± 0.07	47.42 ± 0.09
2	Stem	13.47 ± 0.03	69.25 ±0.05	25.07 ± 0.08
3	Leaves	31.59 ± 0.26	25.35± 0.09	35.30 ± 1.47
4	Aerial parts	54.15 ± 0.28	62.76±0.36	51.73±0.36
5.	Fruit	38.46±0.03	43.26 ± 0.17	36.07 ± 0.09

Values represented mean ± S.D. of three parallel measurements.

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