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Phytochemical evaluation and quantification of primary metabolites of *Maytenus emarginata* (Willd.) Ding Hou

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ABSTRACT

Medicinal plants are the most exclusive source of life saving drugs for the majority of the worlds population. Medicinal plants are of great interest to the researchers in the field of biotechnology as most of the drug industries depend, in part, on plants for the production of pharmaceutical compounds. Laboratory evaluations were made to assess the phytochemical screening and quantification of primary metabolites in Maytenus emarginata (Willd.). The highest amount of soluble sugar (45.8±1.04mg/gdw), protein (30.88±0.5 mg/gdw) and lipid (95.4±0.88mg/gdw) was observed in fruits, starch (82.8±0.77mg/gdw) and phenol (9.26±0.29mg/gdw) was observed in roots, amino acid (13.12 ±0.74mg/gdw) and ascorbic acid (13.88±0.3mg/gdw) was observed in leaves as compared to other parts of the plant. Maximum extractive value (4.230%) was found in water extract among test solvents.

Keywords: Medicinal plants, Primary metabolites, *Maytenus emarginata*, Phytochemical.

INTRODUCTION

There are hundreds of medicinal plants that have a long history of curative properties against various diseases and aliments. Plants have formed the basis of sophisticated traditional medicine systems among which are Ayurvedic, Unani, and Chinese. These systems of medicine have given rise to some important drugs which are still in use [1, 2]. Primary metabolites are substances widely distributed in nature, occurring in one form or another in virtually all organisms. In plants such compounds are often concentrated in seeds and vegetative storage organs and are needed for physiological development because of their role in basic cell metabolism [3]. Primary metabolites, for example; sugars, proteins, lipids, and starch are of

prime importance and essentially required for growth of plants. The studies of primary metabolites have been carried out in some plants in the past such as *Balanites aegyptiaca, Cissus quadrangularis, Eclipta alba* and *Nerium indicum*. [4].

Maytenus emarginata (Willd.) belongs to the family Celastraceae, popularly known as "kankero/kankari",is an evergreen tree that tolerates various types of stresses of the desert and is found in drier parts of central, south-western and north-western India. It provides fodder, timber and fuel. Besides this, it has also medicinal value. In Africa, the root is used in gastero-intestinal troubles, especially to cure dysentery. Pulverized leaves are given in milk to children as a vermifuge. A decoction of the leafy twigs is used as a mouth wash to relieve toothache. The extract of plant shows cytotoxic effect on some cancers. The plant is reported to possess antiplasmodic properties. The bark is ground to a paste and applied with mustard oil to kill lice in the hair [5].

Phytochemicals are naturally occurring biochemical in plants that give plants their color, flavor, smell and texture. Preliminary phytochemical screening of medicinal plants is a useful method for qualitatively determination of different metabolite in crude sample. Many primary metabolites lie in their impact as precursors or pharmacologically active metabolites in pharmaceutical compounds such as antipsychotic drugs [6, 7].

EXPERIMENTAL SECTION

Collection of plant material

Plant material collected from nursery of Rajasthan University in Jaipur district of Rajasthan. Plant material was authenticated by Herbarium, Department of Botany, Rajasthan University, Jaipur, Rajasthan, India.

Preparation of extracts

The stem, leaf, fruit and roots of *Maytenus emarginata* (Willd.) was cut into small pieces, dried and powdered. The resultant was then subjected for successive extraction with petroleum ether, benzene, chloroform, ethanol and water with soxhlet apparatus. The extracts were then concentrated in vacuum under reduced pressure using rotary flash evaporator and dried in desiccators. These extracts were then subjected to preliminary phytochemical screening for the detection of various plant constituents. Each of these extracts was processed further to evaluate the presence of sugar, proteins, tannins, flavonoids, alkaloids, fats &oil and steroids following the established protocols [8]. The powder was treated with acids like 1N HCl, H_2SO_4, HNO_3, Acetic acid and alkaline solutions like 1N NaOH and ammonia. Root, stem, fruit and leaf parts of *Maytenus emarginata* (Willd.) were evaluated quantitatively to estimate the total levels of soluble sugars, starch, proteins, lipids, phenols, amino acid and ascorbic acid following the established methods for the sugars, starch [9], protein [10], lipids [11], phenols [12], amino acid [13], ascorbic acid [14]. All experiments were repeated five times for precision and values were expressed in mean ± standard deviation in terms of air dried material. (Table 4)

RESULT

Photochemical screening: The shade dried plant material subjected to sequential extraction in petroleum ether, ethanol, benzene, chloroform, and aqueous solvents. Maximum yield were found in aqueous extract (4.230%). Total extractive values are shown in table 1.

Table- 1: Successive solvent extraction of air dried plant material of *Maytenus emarginata* (Willd.) Ding Hou.

S.N0.	Solvent	Color and Consistency	Extractive value (%w/w)
1.	Petroleum ether	Yellowish green viscous	0.537
2.	Ethanol	Yellowish green sticky	2.705
3.	Benzene	Yellowish green sticky	0.835
4.	Chloroform	Yellowish green viscous	0.695
5.	Aqueous	Brownish powder	4.230

Preliminary phytochemical investigation revealed that aqueous extract contains protein, sugar, flavonoids and alkaloids, ethanol extract contains sugar, flavonoids, steroids and fats & oil, methanol extract contains protein, sugar, tannins, flavonoids, alkaloids and fats & oil, acetone extract contains sugar, tannins, steroids, alkaloids, fats & oil. (Table 2)

Table -2: *Preliminary Phytochemical Test for Different Extracts of Maytenus emarginata* (Willd.) Ding Hou. (Obtained by Successive Solvent Extraction)

S.No	Test	Aqueous	Ethanol	Methanol	Acetone
1.	**Protein**	+	-	+	-
2.	**Sugar**	+	+	+	+
3.	**Tannins**	-	-	+	+
4.	**Flavonoids**	+	+	+	-
5.	**Alkaloids**	+	-	+	+
6.	**Steroids**	-	+	-	+
7.	**Fats & Oil**	-	+	+	+

+ Relative intensities
- No reaction

The powdered material of *Maytenus emarginata* treated with different acids, bases and other chemicals. After treatment powder observed and fluorescence were tabulated in table 3.

Table- 3: Fluorescence Analysis of Drug Powder of *Maytenus emarginata* (Willd.).

S.No	Test	Color
1	Powder + HNO3	Dark red
2	Powder+5% FeCl3	Dark gray
3	Powder+ Acetic Acid	Gray yellow
4	Powder+ Acetic Acid +H2SO4	Black gray
5	Powder+5% Iodine solution	Green yellow
6	Powder+10% NaOH+CuSO4	Gray yellow
7	Powder+ conc. HNO3+excess NH3	Yellow red
8	Powder+ Diluted NH4+ K4Fe(CN)4	Blue gray
9	Powder+40% NaOH + few drops of Lead Acetate	Yellow orange

Primary metabolites soluble sugar, starch, proteins, lipid, amino acid, ascorbic acid and total phenolic contents are quantified in different plant parts (root, stem, fruit and leaves) and shown in table 4.

Table 4. Concentration of primary metabolites in Maytenus emarginata (Willd). (mg/gdw)*

Plant part / Experiment	Root	Stem	Leaf	Fruit
Sugar	40.4±1.68	18.4±1.65	40.8±1.12	**45.8±1.04**
Starch	82.8±0.77	38.15±0.4	73.95±0.75	**28.25±0.5**
Protein	27.64±0.91	14.2±0.64	20.3±0.68	**30.88±0.5**
Lipid	75.6±0.88	46.2±1.04	75.2±0.64	**95.4±0.88**
Amino acid	12.4±0.88	13.06±0.64	13.12±0.74	**10.52±0.41**
Ascorbic acid	12.64±0.47	11.06±0.52	13.38±0.3	**12.44±0.47**
Phenol	**9.26±0.29**	**5.16±0.49**	**6.36±0.39**	**6.6±0.88**

**mg/gdw- milligram per gram dry weight*
Data are presented as mean ±S.E.M.

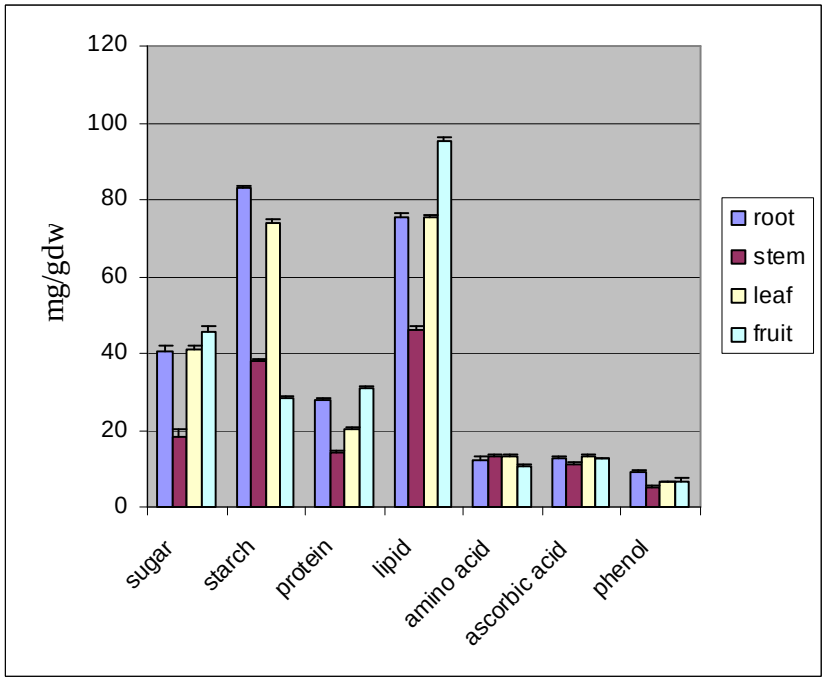

Figure 1: Concentration of primary metabolites in *Maytenus emarginata* (Willd.) (mg/gdw)

Quantitative estimation of sugar shows that content of sugar is more in fruit i.e 45.8±1.04mg/gdw and minimum in stem i.e. 18.4±1.65mg/gdw. The maximum amount of starch was found in root 82.8±0.77mg/gdw and minimum amount was observed in fruit 28.25±0.5mg/gdw. Maximum amount of protein was observed in fruit 30.88±0.5mg/gdw and minimum amount was observed in stem 14.2±0.64mg/gdw. Total levels of lipids were found to be higher in fruit 95.4±0.88mg/gdw and minimum in stem 46.2±1.04mg/gdw. The maximum amount of amino acid was found in leaf 13.12±0.74mg/gdw and minimum in fruit 10.52±0.41mg/gdw. The maximum amount of ascorbic acid was found in leaf 13.88±0.3mg/gdw

and minimum in stem 11.06±0.52mg/gdw. Total levels of phenols were found to be higher in root 9.26±0.29mg/gdw and minimum in stem 5.16±0.49mg/gdw.

DISCUSSION

Preliminary phytochemical screening of plant is very useful for determination of the active constituents in different solvents and their yields. Most of the active principles are found in alcoholic and aqueous extracts. Our results were in agreement of previous reported results. Many primary metabolites lie in their impact as precursors or pharmacologically active metabolites in pharmaceutical compounds. Plant synthesizes primary metabolites (lipid, protein, starch, sugars, phenol etc.) for the normal growth and development of itself. Many polysaccharides purified from Chinese medicinal herbs and phenols are bioactive and possess immuno-modulating, anti-tumor and antibacterial activities [15].

CONCLUSION

In present investigation we found maximum extractive value (4.230%) found in water extract among test solvents. All the metabolites were qualitatively present in water and ethanolic extracts. The highest amount of soluble sugar (45.8±1.04mg/gdw), protein (30.88±0.5mg/gdw) and lipid (95.4±0.88mg/gdw) was observed in fruits, starch (82.8±0.77mg/gdw) and phenol (9.26±0.29mg/gdw) was observed in roots, amino acid (13.12 ±0.74mg/gdw) and ascorbic acid (13.88±0.3mg/gdw) was observed in leaves as compared to other parts of the plant. This study shows that plants parts having rich primary metabolites could be used industrially as raw materials. Therefore, economic use depends partially on the quantitative and qualitative aspects of there organic reserves, specially carbohydrates, proteins, phenols and lipids. These primary metabolites further used for biosynthesis of secondary metabolites or bioactive compounds.

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