

SCREENING OF PIVOTAL MEDICINAL PLANTS FOR QUALITATIVE AND QUANTITATIVE PHYTOCHEMICAL CONSTITUENTS

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ABSTRACT

Objectives: The Objective of the present study is a Comparative study of qualitative and quantitative phytochemicals of aqueous leaf extracts of three medicinal plants namely *Abrus precatorius*, *Adhatoda vasica* and *Catharanthus roseus*.

Methods: In qualitative and quantitative analysis, the phytochemical compounds such as proteins, carbohydrates, lipids, phenols, tannins, flavonoids, saponins and alkaloids were Screened and successfully estimated in three medicinal plants by using standard methods.

Results: In Qualitative analysis of leaf aqueous extract of these three medicinal plant species confirm that various Secondary metabolites like alkaloids, tannins, phenols, lignins and primary metabolites like reducing sugars, proteins and carbohydrates are present and fixed oils and anthoquinones are absent. Quantitative estimation of primary and secondary metabolites of these three plant species revealed that the highest levels of carbohydrates, saponins, tannins are found in *C.rosea* when compare to other plants *A.vasica* is the rich source of lipids, phenols, alkaloids whereas highest levels of proteins and flavonoids are found in *A. precatorius*.

Conclusion: The results indicate that the biochemical compounds for curing various ailments are found in the leaves of three selected medicinal plants and possess potential antioxidant and leads to the isolation of novel compounds.

Keywords: Traditional medicinal plants, Phytochemical constituents, Secondary metabolites.

INTRODUCTION

India is endowed with rich wealth of medicinal plants. India recognizes more than 2500 plant species which have medicinal values [1]. Herbal medicines have become more popular in the treatment of many diseases due to popular belief that green medicine is safe, easily available and less side effects [2].

A characteristic of plant life is the production of a vast number of natural compounds, often called secondary metabolites. Phytochemicals are basically divided in two groups that are primary and secondary metabolites based on the function in plant metabolism. Secondary metabolites consist of alkaloids, saponins, steroids, flavonoids, tannins and so on [3]. Secondary metabolites have crucial role in plant development as well as in the interaction of a plant with its biotic and a biotic environment. Phytochemical constituents are the basic source for the establishment of several pharmaceutical industries and establishment of crude drugs [4]. Recently numbers of plants were screened for secondary metabolites for their medicinal values *Svensonia hyderabadensis* [5], *Boswellia ovalifoliolata* [6], *Allamanda cathartica* [7] and *Cochlospermum religiosum* [8].

The phytochemical research based on ethno-pharmacological information is generally, considered an effective approach in the discovery of new anti-infective agents from higher plants. The qualitative and quantitative analysis is very essential for identifying and quantification of active principles present in the medicinal plants which is an important for medicinal action and drug preparation. Keeping this in view the plants *Abrus precatorius*, *Adhatoda vasica* and *Catharanthus roseus* were selected based on their extensive use in the preparation of green medicine.

Abrus precatorius Linn. belongs to the family Fabaceae commonly known as rosary pea and ratti, is a medicinal herb used for various diseases. The plant parts are purgative, emetic, toxic, anti-phlogistic, aphrodisiac, anticancer, anthelmintic, abortive, antidiarrheal, antimicrobial, diuretic, laxative, antipyretic and anti-ophthalmic [9]. In India hot water extract of dried leaves and roots are applied to the eye to treat eye diseases. In Brazil, water extract of dried leaves and roots taken orally as a nerve tonic [10].

Adhatoda vasica Nees belongs to the family Acanthaceae. This leaf (Vasaka), known as vasa in Ayurveda is an important drug prescribed for malarial fever, intrinsic hemorrhage, cough and asthma, leprosy, skin diseases and piles, it is reported to be an expectorant, antidiabetic, anti-inflammatory [11], abortifacient, antimicrobial [12], anti-tussive and anti cancer [13], important chemical constituents of leaf include Pyrroloquinazoline, alkaloids, vasicine, vasicol, adhatonine, vasicinone, vasicinol, vasicinolone. Vasicine was reported to have bronchodilatory, respiratory, weak Cardiac stimulant and uterine stimulant effect.

Catharanthus roseus is an important medicinal plant of the family Apocynaceae that is used to treat many fatal diseases. The species has long been cultivated for herbal, medicine and ornamental plant. In traditional medicine extract for has been used to treat numerous diseases, including leukemia, hodgkin's diseases. Malignant lymphomas, neuro blastoma, rhabdomyosarcoma, wilm's tumour and other cancers [14]. Its vasodilating and memory enhancing properties have been shown to alleviate vascular dementia and Alzheimer's disease [15]. The two classes of active compounds in vinca are alkaloids and tannins. The major alkaloid is vincamine and its closely related semi-synthetic derivative widely used as a medicinal agent, known as ethyl-apovincaminatate or vincocetine has vasodilating blood thinning hypoglycemic and memory-enhancing actions. The study aims at making qualitative and quantitative analysis of certain phytochemical constituents in three plants.

MATERIALS AND METHODS

Fresh and healthy leaves of three different plant species free from diseases were collected during the month of June 2011 from S.V.U. Botanical Garden. Taxonomic identification of the plants were carried with the help of Gamble [16] and also compared with the herbarium present in Department of Botany, Sri Venkateswara University, Tirupati, Andhra Pradesh, India. Primarily the leaves were washed with distilled water, cleaned and pressed with blotted paper. Then the leaves were shade dried and ground to make a fine powder. Phytochemical screening was carried out with dry powders by following the methods of Gibbs [17] and Herbon [18] and quantitative analysis of proteins [19], carbohydrates [20], lipids [21], phenols [22], flavonoids [23], saponins [24], alkaloids [25], tannins [26] and anthocyanins [27].

RESULTS AND DISCUSSION

The phytochemical screening and quantitative estimation of Secondary metabolites of *Abrus precatorius*, *Adhatoda vasica* and *Catharanthus roseus* showed that the leaves are rich in proteins, lipids, carbohydrates, phenols, tannins, flavonoids, saponins, alkaloids and anthocyanins. The results are summarized in Table-1 and 2. Proteins are found to be higher in *Abrus precatorius* i.e. 0.078 mg/g dw, which are primary components of living organisms. Proteins are essential to maintaining the structure and function of all life and vital for growth and development. The presence of higher protein level in the plants points towards their possible increase in food value or that a protein based bioactive compound could also be isolated in future [28]. The maximum levels of lipid content were found in *Adhatoda vasica* i.e. 0.7 mg/g dw. The higher amount of plant lipid can be used as essential oils, spice, oleoresins and natural food colors. plant lipids have developed products that work with diverse requirements, as culinary, medicinal and cosmetics [29]. Total content of carbohydrates was found to be maximum in *Catharanthus roseus* i.e. 0.11 mg/g dw. Carbohydrates are one such group of carbon compounds, which are essential to life.

Almost all organisms use carbohydrates as building blocks of cells and as a matter of fact, exploit their rich supply of potential energy to maintain life. Maximum levels of phenols were found in *Adhatoda*

vasica i.e. 90.4 mg/g dw. Phenolics are secondary metabolites that are ubiquitously present in fruits. Many of the phenolics have been shown to contain higher levels of antioxidant activities [30]. Endogenous phenolics may also play a role in inhibiting the fruit browning process. Nutritional quality of fruit tissue is in part a function carbohydrate metabolism, colour, pigment, and flavonoid, phenolic content and anti-oxidative capacity. Antioxidants provide chemical protection for biological systems against harmful effects of reaction or process that cause excessive oxidation, protein and DNA damage and cell death.

Several studies have indicated that antioxidants prevent the onset of degenerative illness such as certain cancers, cardiovascular and neurodegradative diseases, contracts, oxidative stress dysfunctions and aging [31]. Total content of tannins were found to be higher in *Catharanthus roseus* i.e. 0.034 mg/g dw, the growth of many fungi, yeasts, bacteria and viruses was inhibited by tannins. A part from these tannins contribute the property of astringent activity i.e. faster the healing of wounds and inflamed mucous membrane [32, 33]. Maximum levels of flavonoids were found to be higher in *Abrus precatorius* i.e. 0.077 mg/g dw. Flavonoids are reported to possess many useful properties, including anti-inflammatory, antimicrobial, enzyme inhibition, oestrogenic, antiallergic, antioxidant and anti-tumour activity [34,35].

Table 1: Phytochemical screening of leaves of three important medicinal plants

S. No.	Primary screening for secondary metabolites	<i>Abrus precatorius</i>	<i>Adhatoda vasica</i>	<i>Catharanthus roseus</i>
1.	Flavonoids	+	-	+
2.	Tannins	+	+	+
3.	Glycosides	++	++	+
4.	Steroids	+	+	-
5.	Saponins	-	-	++
6.	Phenols	+	++	+++
7.	Triterpenoids	+	-	+++
8.	Reducing sugars	+	++	+++
9.	Anthocyanins	-	-	+
10.	Carbohydrates	+	+	+
11.	Proteins	+	+	++
12.	Alkaloids	+	++	+
13.	Fatty acids	-	-	-
14.	Lignins	++	++	+
15.	Anthroquinones	-	-	-

Note: '+' indicates present, '-' indicates absence

Table 2: Quantitative analysis of primary and secondary metabolites of leaves of 3 selected medicinal plant species.

S. No.	Biochemical compounds	Plant species		
		<i>Abrus precatorius</i>	<i>Adhatoda vasica</i>	<i>Catharanthus roseus</i>
1.	Proteins	0.078 ± 0.12	0.054 ± 0.07	0.068 ± 0.009
2.	Lipids	0.2 ± 0.057	0.7 ± 0.05	0.04 ± 0
3.	Carbohydrates	0.075 ± 0.003	0.061 ± 0.01	0.11 ± 0.02
4.	Phenols	16.5 ± 0.87	90.4 ± 4.5	15 ± 0.2
5.	Tannins	0.022 ± 0.4	0.025 ± 0.1	0.034 ± 0.002
6.	Flavonoids	0.077 ± 0.04	-	0.052 ± 0.15
7.	Saponins	-	-	0.31 ± 0.15
8.	Alkaloids	0.05 ± 0	0.07 ± 0.1	0.04 ± 0
9.	Anthocyanins	-	-	0.016 ± 0.08

'±' Values are the average of triplicates standard error.

Maximum levels of saponins are present in *Catharanthus roseus* i.e. 0.31 mg/g dw. Traditionally saponins have been extensively used as detergents, as pesticides and molluscides, in addition to their industrial applications as foaming and surface active agents and also have beneficial health effects [36]. The highest levels of alkaloids were found to be maximum in *Adhatoda vasica* i.e. 0.07 mg/g dw. The alkaloids are one of the most diverse groups of secondary metabolites found in living organisms and have an array of structure types, biosynthetic pathways, and pharmacological activities.

The presences of alkaloids contained in plants are used in medicine as aesthetic agents. Maximum content of anthocyanins were present only in *Catharanthus roseus* i.e. 0.016 mg/g dw. In food industry, natural red pigments are used as an alternative to synthetic colorants, which needs quality control to determine the authentic activity of products and to detect adulteration [37]. In qualitative analysis, maximum numbers of secondary metabolites were found in *Catharanthus roseus* and minimum numbers of secondary metabolites are present in *Abrus precatorius*. Exploitation of these pharmacological properties involves further investigation of active

ingredients by implementation of technique like extraction, purification, separation, crystallization and identification.

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