



Phytochemical screening and elemental analysis in different plant parts of *Uraria picta* Desv.: A Dashmul species

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ABSTRACT

Phytochemicals are the naturally occurring compounds present in all plant parts which together with nutrients and fibres provide protection to plants and humans against diseases. Development of rapid and accurate methods of screening of medicinal plants for particular chemicals has aided phytochemical analysis enormously. In this paper, extracts of leaves, stem and roots of *Uraria picta* in various solvents have been screened for qualitative determination of phytochemical constituents i.e. secondary metabolites (alkaloids, flavonoids, steroids, terpenoids, phenols, saponins, tannins and cardiac glycosides). Along with this, macro elements (Na, K, Ca, Mg, P) which are essential for maintaining the animal body were also determined quantitatively in leaves (Na – 0.04%, K - 0.67%, Ca- 1.81%, Mg-0.21% and P- 0.04%), stem (Na- 0.04%, K-0.73%, Ca – 1.41%, Mg – 0.11% and P- 0.07%) and roots (Na-0.02%, K- 0.46%, Ca-0.82%, Mg- 0.13% and P- 0.05%) of the plant. Phytochemicals investigated are biologically active compounds to combat diseases and elements to maintain good health.

Key words: *Uraria picta*, phytochemicals, elements, leaves, stem, roots

INTRODUCTION

Medicinal plants have been used as herbal drugs since times immemorial. All plant parts (leaves, flowers, stem, roots, seeds, bark etc.) may be used as herbal drugs in particular or in combinations of each other. The medicinal value of plants lies in bioactive phytochemical constituents that produce specific physiological action on the human body [1]. Phytochemicals can be classified into two groups viz. primary and secondary according to their function in the plant body. Primary metabolites (sugars, amino acids, proteins, lipids, chlorophyll etc) are required for growth while secondary metabolites (alkaloids, essential oils, flavanoids, tannins, terpenoids, saponins, phenolic compounds, cardiac glycosides etc.) play an important role in plant defense against herbivory [2, 3, 4] and other interspecies defenses. Secondary metabolites form the backbone of the modern medicine [5]. Humans use secondary metabolites as medicines, flavorings and recreational drugs.

There is a great interest in macro and trace element composition of medicinal plants. It is believed that great majority of elements act as key components of essential enzymes for vital biochemical functions. Various minerals or inorganic nutrients are also required for maintaining the health of the body and accordingly are consumed as herbal health drinks or in orthodox medicines [6, 7]. The quantitative estimation of trace elements concentration is important for determining the effectiveness of medicinal plants in treating various diseases and also to understand the pharmacological action [8].

Uraria picta Desv. (Syn. *Doodia picta* Roxb., *Hedysarum pictum* Jacq.) is commonly known as Prishnaparni or Pithvan and belongs to the family Leguminosae: Papilionoidae. It is an erect, little branched, perennial herb, 90 – 180 cm tall, stems with short, rough hairs, leaves imparipinnate with 5-9 leaflets (lowermost leaves often 1-3-foliolate); leaflets narrowly lanceolate, 7-25 cm long (lowermost smaller), often variegated, shiny and hairless above, rough hairy below; margins entire, inflorescence a long terminal densely many-flowered spike-like raceme, up to 55 cm long, covered in long whitish hairs, flowers pink, bluish or reddish, fruit 5-9 mm long, folded into 3-6 segments, brown to black, turning greyish-white when old. It is widely distributed throughout India, Bangladesh, Sri Lanka, Tropical Africa, Malay Islands, Philippines, Australia, Africa and almost all parts of Asia [9, 10, 11, 12, 13]. It is one of the important constituent of “Dashmula”, a well established Ayurvedic ten herbal formulation of the Indian system of medicine used for treating fatigue, oral sores and gynaecological disorders [14]. The leaves of *U picta* were also showed antianxiety activity [15].

This study adds to the fundamental scientific knowledge through qualitative analysis of phytochemical constituents and quantification of macro elements present in different plant parts of *Uraria picta*.

EXPERIMENTAL SECTION

2.1 Materials

The plant material was collected from Chhindwara district of Madhya Pradesh. The plant parts (stem, roots and leaves) were separated and washed thoroughly in running water to remove soil and other foreign particles. They were dried in shade followed by oven drying at 40°C before grinding. The major equipments used for the study were UV-VIS spectrophotometer and Flame photometer. Chemicals used were of LR and AR grade.

1.2 Preparation of extracts

100 mg of dried and powdered plant materials were soaked overnight in 25 ml of different solvents namely water, methanol, ethanol, petroleum ether, chloroform, diethyl ether and ethyl acetate. The different extracts were filtered and the filtrates were used for qualitative phytochemical analysis.

2.3 Preliminary phytochemical analysis

The preliminary phytochemical analysis of the crude extracts of leaves, stem and roots of *U. picta* were carried out according to the method described by Harborne, Trease and Evans [16, 17].

2.4 Macro element analysis

Macro elements such as Sodium, Potassium, Calcium, Magnesium and Phosphorus were estimated using standard method [18].

2.5 Statistical Analysis

Each experiment was carried out in triplicate and results expressed as Mean \pm SD (n=3).

RESULTS AND DISCUSSION

3.1 Qualitative phytochemical analysis

The preliminary phytochemical qualitative analysis of leaf, stem & root extracts of *Uraria picta* is summarized in Table 1.

The results showed the presence of alkaloids, flavonoids, steroids, terpenoids, phenols and saponins in all plant parts. Tannins were absent in stem and roots whereas cardiac glycosides were absent in roots. Preliminary phytochemical screening actually helps in isolating and characterizing the chemical constituents present in the plant extracts and the knowledge of the chemical constituents of plants is desirable to understand herbal drugs and their preparations and finally in discovering the actual value of folkloric remedies [19]. Phytochemicals such as alkaloids, flavonoids, steroids, terpenoids, cardiac glycosides, phenols, saponins and tannins present in different extracts exhibit a number of biological activities and protect from most of the chronic diseases [20, 21].

Alkaloids have various pharmacological effects such as antiarrhythmic, anticholinergic, analgesic, antitumor, antihypertensive, antipyretics, antimalarial, stimulant, anti-HIV, antileukmic and many more [22] and often used as medications and recreational drugs [23].

Table 1. Qualitative phytochemical analysis of Leaves

S. No.	Phytochemical Constituents	Plant Parts	Aqueous extract	Methanol extract	Ethanol Extract	Chloroform extract	Diethyl Ether extract	Pet. Ether extract	Ethyl Acetate extract
1.	Alkaloids	Leaves	-	+	-	-	-	-	-
		Stem	-	+	+	-	-	-	-
		Roots	-	+	-	-	-	-	-
2.	Flavonoids	Leaves	+	+	+	-	-	-	-
		Stem	-	+	-	+	-	-	-
		Roots	-	+	+	-	-	-	-
3.	Steroids	Leaves	+	+	-	+	+	+	+
		Stem	-	+	+	-	-	+	+
		Roots	+	-	+	-	-	+	+
4.	Terpenoids	Leaves	+	+	+	+	+	-	+
		Stem	-	+	+	+	-	+	+
		Roots	+	+	+	+	-	+	+
5.	Cardiac glycosides	Leaves	-	-	+	+	+	-	+
		Stem	-	+	+	+	-	+	+
		Roots	-	-	-	-	-	-	-
6.	Phenols	Leaves	-	+	-	-	-	-	-
		Stem	-	+	-	-	-	-	-
		Roots	+	-	-	-	-	-	-
7.	Saponins	Leaves	-	-	+	-	-	-	-
		Stem	+	-	-	-	-	-	-
		Roots	+	+	-	-	-	-	-
8.	Tannins	Leaves	-	+	+	-	+	-	+
		Stem	-	-	-	-	-	-	-
		Roots	-	-	-	-	-	-	-

(+) Presence, (-) Absence

Flavonoids are the most common group of polyphenolic compounds in the human diet and are found ubiquitously in plants. The pharmacological effects of flavonoids include CNS activity, cardiogenic, lipid lowering, antiulcer, hepatoprotective, anti-inflammatory, antineoplastic, antimicrobial, antioxidant and antihypoglycemic activity. Dietary intake of flavonoids containing foods potentially lowers the risk of certain free radical related pathophysiology [24].

Steroids and triterpenoids are pharmacologically active compounds and show the analgesic properties [25]. The steroids also exhibit central nervous system activities. Luo *et al.*, [26] reported the terpenoids to decrease blood sugar level in animals.

Cardiac glycosides are also of medicinal importance and used in the treatment of congestive heart failure and cardiac arrhythmia [27].

Phenols and phenolic compounds have tremendous antimicrobial potential. They have been extensively used in disinfections and remained the standards with which other bactericides are compared [28]. They have been reported to exhibit cellular defense mechanism in atherogenesis and cancer. A wide range of phenolic substances show strong antioxidant and antimutagenic activities. As per recent evidences, phenolic compounds could also play an essential health promoting role [29].

Saponins are being promoted commercially as dietary supplements and nutraceuticals in traditional medicine preparations [30]. They also possess hypocholesterolemic and antidiabetic properties [31].

Certain tannins (ellagitannins from *Lagerstroemia speciosa*) stimulate glucose uptake. They exhibit insulin like activity acting as glucose transport activators of fat cells [32].

3.2 Macro elements Analysis

Highest percentage of sodium was found in leaves & stem followed by root, whereas, for magnesium highest amount was found in leaves followed by roots and stem. In case of potassium, stem ranked first followed by leaves and roots. The highest percentage of calcium was found in leaves followed by stem and roots. Similarly, highest percentage of phosphorus was found in roots followed by stem and leaves. Macro elements analysis of different plant parts of *Uraria picta* is given in Table 2.

Table 2. Macro elements in different plant parts of *Uraria picta*

S. No.	Plant parts	Percentage of Macro elements (%)				
		Sodium	Magnesium	Potassium	Calcium	Phosphorous
1.	Leaves	0.04±0.01	0.21±0.27	0.67±0.01	1.81±0.09	0.04±0.02
2.	Stem	0.04±0.01	0.11±0.03	0.73±0.01	1.41±0.09	0.07±0.01
3.	Roots	0.02±0.01	0.13±0.06	0.46±0.01	0.82±0.16	0.05±0.01

The result of the mineral composition clearly shows that plant parts of *U. picta* have considerable amount of mineral elements. This result becomes so important when the usefulness of such mineral like Ca, Mg, P, K and Na in the body is considered [33].

Sodium is one of the chief extracellular ions in the Human Body. However, the lower Na content (0.04% in leaves & stem each and 0.02% in roots) of *U. picta* is an added advantage because of the direct relationship of sodium intake with hypertension in human [34].

Potassium is the principal intracellular cation and helps to regulate osmotic pressure and pH equilibrium. Mineral elements like potassium, zinc, calcium, traces of chromium and magnesium play an important role in the maintenance of normal glucose-tolerance and in the release of insulin from beta cells of islets of langerhans [35]. The leaves and stem are rich in calcium. This may facilitate the efficient release of insulin from beta-cells more efficiently [36].

Increased dietary intake of Ca is currently recommended for the general population to lower the risk of hypertension and osteoporosis. Dietary supplementation of Ca also lowers serum cholesterol [37]. Hence, the leaves and stem may also have hypolipidemic properties due to the good content of calcium.

Magnesium is very important for regulating electrical potential in nerves and membranes. It also plays an important role in improving insulin sensitivity, protect against diabetes and its complications and also reduce blood pressure [38].

Phosphorus is second to calcium found in the human body. Both Ca and P work together to build strong bones and teeth. 85% phosphorus is present in bones and teeth only, but its presence is also reported in cells and tissues throughout the body. Phosphorus deficiency causes rickets in children [39] and osteomalacia in adults [40]. It plays an important role in filtering of wastes through the kidneys, in energy storage and its usage. It is very essential for the growth, maintenance and repair of all tissues and cells of the body. It is also the one of the constituent of genetic building blocks, DNA and RNA.

CONCLUSION

The phytochemical screening of different plant parts of *Uraria picta* revealed the presence of important secondary metabolites in all parts. Since the roots of plant have already been used for formulation of well known drug Dashmularishta, its other parts may also have a huge biological potential for preparation of various other herbal formulations to cure diseases. Considerable amount of macro elements is present in the plant. The presence of phytochemicals along with minerals can make *U. picta*, a potential food and drug. However, further study is necessary to quantify, isolate, characterize and to evaluate biological activity of the particular compound for drug development.

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