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Physicochemical parameters, phytochemical screening and qualitative analysis of inorganic nutrients of *Persicaria glabra* (Willd.) Gomez de la Maza

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Abstract
The present study investigated with physicochemical parameters, phytochemical analysis, and qualitative analysis of inorganic nutrients of *Persicaria glabra* (Dense flower Knotweed). Physicochemical parameters such as ash values, extractive values were determined. The methanolic extract of *P. glabra* leaves and stem revealed the presence of bioactive compounds such as alkaloids, flavonoids, tannins, glycosides, steroids, terpenoids, saponins, proteins, amino acids, reducing sugars, phenols, emodins, and phlobatannins. Whereas in the stem terpenoids and saponins were absent. The qualitative analysis of inorganic acid radicals in leaves showed the presence of carbonates and sulfates, whereas nitrates, phosphates, and sulfates were found in the stem. The inorganic basic radicals of the leaves and stem revealed the presence of arsenic, sodium, calcium, iron, and ammonium, whereas zinc is only found in the leaves. According to these findings, the presence of phytoconstituents and physicochemical parameters is useful for the development of novel drugs and assessing plant quality. Furthermore, this plant contains vital inorganic nutrient elements that may be useful for humans as dietary supplements for day-to-day life and to heal various ailments.

Keywords: *Persicaria glabra*, physicochemical parameters, extraction, phytochemical analysis, inorganic nutrients

Introduction
Phytochemicals are very simply plant-derived chemicals. They are naturally occurring defense chemicals present in different parts of plants such as leaves, roots, seeds, stems and barks etc. Medicinal plants produce primary and secondary metabolites with different functions. The secondary metabolites like alkaloids, terpenoids, and phenolic compounds are known to be responsible for the therapeutic potential of the medicinal plants.

In this study the physicochemical parameters studied are total ash, acid-insoluble ash, methanol and water soluble extractive values. Ash content is used to determine the quality and purity of crude drugs.

Water-soluble ash is used to estimate the amount of inorganic compounds in drugs, whereas acid-insoluble ash contains silica and indicates contamination with earthy material. The amount of the active constituents in a given amount of plant material when extracted with a particular solvent is determined by the estimation of extractive values.

A solution containing different Phytoconstituents is obtained by the extraction of any crude drug with a particular solvent. Whether the crude drug is exhausted or not is indicated by the composition of these Phytoconstituents, which depend on the nature of the drug and the solvent used.

Persicaria glabra belongs to the family Polygonaceae and is commonly known as dense flower knotweed. This is an entirely glabrous plant, except the leaves which are often red-gland dotted; the ochrea (stipules fused into a sheath surrounding the stem) is completely eciliate. Inflorescence is a dense raceme, small pink with white flowers. Fruits are achene, flattened, shiny, dark brown to black in color. It grows on wet areas like lake, pond, and margins of ditches [1, 2].

It is one of the medicinal plants that are used as an analgesic and anti-cancer. Generally, juice of this herb is used as a painkiller and leaf paste is used as an anti-cancer drug [3]. The present study deals with physicochemical parameters, phytochemical analysis and inorganic nutrients in the leaves and stem of *Persicaria glabra*.

Materials and Methods

Collection and authentication of plant material

The fresh leaves and stems of *Persicaria glabra* were collected from Vellimalai, Anthiyur Taluk, Erode District, Tamil Nadu. The plant species were authenticated (BSI/SRC/5/23/2022/Tech) at the Botanical Survey of India (BSI), Southern Circle, Coimbatore, and the voucher specimen was deposited in the Department of Botany at NGM College, Pollachi.

Preparation of extracts

The collected sample was washed well to remove debris. Then the leaves and stem were shade dried at room temperature. The dried plant materials were ground into powder using a mechanical grinder. The obtained leaves and stem powder were placed in a stoppered container with the solvent, methanol, and allowed to stand at room temperature for a period of three days with frequent agitation until the soluble matter had dissolved. After the extraction, the solvent kept evaporating into the air. Dark green crude was obtained. The crude extracts were stored in the refrigerator. The crude extract was used for further analysis.

Analysis of Physicochemical parameters

The leaves and stem powder of *Persicaria glabra* were analyzed for physicochemical parameters such as percentage of total ash, acid-soluble ash, water-soluble ash, methanol extractive values and water extractive values using standard procedures [4, 5, 6].

Determination of total ash

The powdered material of leaves and stem weighed one gram and was placed in a silica crucible. Spread the powder in an even layer, and it was ignited to a constant weight by gradually increasing the heat to 500-600 °C until it was white, indicating the absence of carbon. The ash was allowed to cool and weighed.

Determination of acid insoluble ash

The total ash was transferred from the crucible into a 50-ml beaker with 2 N HCL and covered with a watch glass. The solution was boiled gently for 5 min. The watch glass was rinsed with 5 ml of hot water and added to the crucible. Acid-insoluble matter was filtered using ashless filter paper, transferred to the crucible. It is dried on a hot plate, and ignited at a constant weight. The obtained material was weighed, and the acid-insoluble ash was calculated.

Determination of water soluble ash

The total ash was transferred from the crucible into a 50-ml beaker with 25 ml of water and covered with a watch glass. The solution was boiled gently for 5 min. The watch glass was rinsed with 5 ml of hot water and added to the crucible. The watch glass was rinsed with 5 ml of hot water and added to the crucible. Water insoluble matter was filtered using ash less filter paper and transferred to the crucible. It is dried on a hot plate and ignited to a constant weight. The obtained material was weighed, and the water soluble ash was calculated.

Determination of extractive values

Methanol soluble extractive

Two grams of powdered plant material accurately weighed. The material was placed in a glass stoppered bottle and added to 40 ml methanol. It was allowed to stand for 24 hours. Then shaking frequently during the 6 hours and allowing for standing for 18 hrs. The extract was filtered, solvent was evaporated and the percentage of alcohol soluble extractive was calculated.

Water soluble extractive

Two grams of powdered plant material accurately weighed. The material was placed in a glass stoppered bottle and added to 40 ml water. It was allowed to stand for 24 hours. Then shaking frequently during the 6 hours and allowing for standing for 18 hrs. The extract was filtered, solvent was evaporated and the percentage of water soluble extractive was calculated.

Phytochemical screening

Phytochemical tests were performed on crude extracts of alkaloids, flavonoids, tannins, glycosides, steroids, terpenoids, saponins, proteins, amino acids, reducing sugars, phenols, emodins, and phlobatannins as per standard protocols [7, 8, 9, 10, 11].

Qualitative analysis of inorganic nutrients

Qualitative analysis of inorganic nutrients of *P. glabra* leaves and stem extract of carbonates, nitrates, phosphates, sulfates, sulfides, lead, arsenic, mercury, copper, ferric, ferrous, zinc, silver, sodium, magnesium, iron, ammonium, potassium, calcium were analyzed using standard procedures [12, 13].

Results and Discussion

Physicochemical parameters

The physicochemical parameters of *P. glabra* leaves and stem were presented in the Table 1. The total ash was found to be high in the stem extract and whereas low in the leaves extract of *P. glabra*. Water soluble ash and acid insoluble ash were higher in the leaves extract and low in the stem. The assessment of the total ash value is crucial for evaluation of purity and quality of drugs. This method is used to measure the total amount of plant material lasting after ignition. Extractive values are used for presence of the polar and nonpolar compounds present in a plant material.

Table 1: Physicochemical parameters of *Persicaria glabra* leaf and stem

S. No	Parameters	Leaves	Stems
Ash values			
1.	Total Ash	4.3 g	5.8 g
2.	Water soluble ash	8 g	5.9 g
3.	Acid insoluble ash	23.3g	18.1g
Extractive values			
4.	Methanol extractive values	2.4 g	4.9 g
5.	Water extractive values	5.8 g	3.5 g

Phytochemical screening

Phytochemical screening of a methanolic extract of *Persicaria glabra* leaves and stem was shown in Table 2. The methanolic extract of *P. glabra* leaves and stem revealed the presence of bioactive compounds such as alkaloids, flavonoids, tannins, glycosides, steroids, terpenoids, saponins, proteins, amino acids, reducing sugars, phenols, emodins, phlobatannins. Whereas terpenoids and saponins were absent in the stem. The present findings concur with the result of [11] where it has been reported that the leaf extract of *P. glabra* contains alkaloids, flavonoids, glycosides, phenol, phlobatannin, resins, sterols, and tannins.

Table 2: Phytochemical analysis of leaves and stem extracts of *P. glabra*

S. No	Phytochemical tests	Methanol	
		Leaves	Stem
1.	**Alkaloids**		
	a) Mayer's test	-	+
	b) Dragendroff's test	+	+
2.	**Flavonoids**		
	a) Ferric chloride	+	+
	b) Alkaline test	+	+
3.	**Tannins**		
	Ferric chloride test	+	+
4.	**Glycosides**		
	a) Liebermann's test	+	+
	b) Salkowski test	+	+
5.	**Steroids**		
	b) Salkowski test	+	+
6.	**Terpenoids**	+	-
7.	**Saponins**		
	Foam test	+	-
8.	**Proteins and Amino acids**		
	Ninhydrin test	+	+
9.	**Reducing sugars**		
	a) Benedict test	+	+
	b) Fehling' s test	+	+
10.	**Phenols**		
	a) Folin-ciocalteau' s test	+	+
	b) Ferric chloride test	+	+
11.	**Emodins**	+	+
12.	**Phlobatannins**	+	+

Qualitative analysis of the inorganic nutrients

The qualitative analysis of inorganic acid and basic radicals of leaves and stem of *P. glabra* were presented in Table 3 and 4. The carbonates were present in the leaves, except the stem. Carbonates play an important role in the regulation of pH and acid balance in various parts of the human body [14].

Nitrates and phosphates were found only in the stem. Whereas nitrates and phosphates were absent in leaves. Phosphate is an integral component of plant cells that helps to maintain blood sugar level, normal heart contraction [15]. For decades, nitrates have been the basis for the treatment of angina. Angina means an uncomfortable feeling, tightening or pain in the chest that can spread arms, back, jaw, neck or stomach [16]. Sulfates were present in both plant parts. Sulfides were absent in either.

Table 3: Qualitative analysis of inorganic acid radicals

S. No	Acid radicals	Inference	
		Leaves	Stem
1.	Carbonates	+	-
2.	Nitrates	-	+
3.	Phosphates	-	+
4.	Sulfates	+	+
5.	Sulfides	-	-

Analysis of inorganic basic radicals revealed the presence of arsenic, sodium, iron, calcium and ammonium in the leaves and stem of *P. glabra*. The basic radicals of lead, mercury, copper, ferric, ferrous, silver, magnesium, and potassium were absent in either plant parts. Arsenic is commonly known as a poison. In the past years, arsenic and its compounds were used as a medicine for the treatment of such diseases as diabetes, psoriasis, syphilis, skin ulcers and joint diseases [17].

Sodium aids in muscle contraction, nerve impulse transmission, and fluid balance in the body. Iron deficiency can cause cellular hypoxia and death.Calcium helps to build strong bones and teeth, as well as aid in muscle contraction, blood clotting, nerve transmission, cell signaling, and metabolism regulation. Calcium deficiency can cause bone to become brittle and easily fractured. Iron helps in the formation of hemoglobin, which transports oxygen in the blood [18].

Ammonia commonly found in nature and also produced in the human body. It is essential for the body as a building block for the formation of proteins and other complex molecules [19].

Zinc is only present in the leaves. It helps to construct and maintain DNA, which is required for the growth of body tissues and is an important component of ligaments and tendons. Zinc deficiency can lead to growth delay, diarrhea and abnormalities of fetal development [20, 21, 22].

Table 4: Qualitative analysis of inorganic basic radicals

S. No	Basic radicals	Inference	
		Leaves	Stem
1.	Lead	-	-
2.	Arsenic	+	+
3.	Mercury	-	-
4.	Copper	-	-
5.	Ferric	-	-
6.	Ferrous	-	-
7.	Zinc	+	-
8.	Silver	-	-
9.	Sodium	+	+
10.	Magnesium	-	-
11.	Iron	+	+
12.	Ammonium	+	+
13.	Potassium	-	-
14.	Calcium	+	+

Persicaria glabra is one of the essential traditional medicinal plants. It has several medicinal properties. The leaves of *P. glabra* can be a source of herbal medicine to efficiently treat some specific human diseases. It has high antioxidant properties that can treat oxidative stress [1].

Conclusions

In the present study, *P. glabra* leaves and stem were investigated for their physicochemical parameters, such as total ash, water-soluble ash, and acid-insoluble ash values, which show their quality, safety, and standardization as drugs. The methanolic extract of *P. glabra* leaves and stems revealed the presence of lots of phytochemical constituents that may be useful for human welfare. However, further research is recommended for the isolation and quantification of individual Phytoconstituents that may be useful for the pharmacology industry in drug development.

Moreover, the plant contains important mineral contents such as zinc, sodium, iron, and calcium that may be helpful for humans as dietary supplements for day-to-day life and to combat various diseases.

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