Morphological, Phytochemical Investigation and Nutritional Values on Leaves of *Polygonum hydropiper* L.

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Abstract

The present studies provide an account of the knowledge on morphology, phytochemical investigation and nutritional values on leaves of *Polygonum hydropiper* L. It is distributed worldwide and found native in temperate and tropical Asia, which is belonging to the family Polygonaceae. The specimens were collected from Kyaing Tong Town and identified with the help of available literatures. In morphological studies, this plant is annual suberect herbs; leaves simple, alternate; inflorescences terminal spike-like racemes; flowers pink or white; stamens 6; ovary superior and fruits achenial. In phytochemical investigation of powdered leaves were carried out Marini Bettalo *et al*., 1981, Central Council for Research in Unani Medicine, 1987 and Trease and Evans, 2002, indicated the presence of carbohydrate, glycoside, phenolic compound, α- amino acid, flavonoid, steroid, terpenoid and reducing sugar, which may be boiactive compounds. The nutritional values had been undertaken according to the Association of Official Analytical Chemists (AOAC) method, revealed the presence of moisture, ash, protein, fat, fiber, carbohydrate, sugar, acidity and energy value. So *Polygonum hydropiper* L. is nutritious and important medicinal plant.

Key words: *Polygonum hydropiper* L., morphology, phytochemical investigation, nutritional values

Introduction

Polygonum hydropiper L. is one of the most numerous geniuses in the family Polygonaceae, which has a long history of use in folk medicine as remedy for the treatment of a multiplicity of disorders [2]. The species is commomly known as marsh-pepper smartweed, marsh-pepper knotweed, smartweed, or water pepper [10, 11, 30] and also called phet-phe in Myanmar. The plant is distributed from the tropics in the Northern hemisphere to the temperate zone and grows wildly in watersides and marshes [22]. This plant is also distributed in Kachin State, Sagaing Division, Shan State and Yangon Division of Myanmar [20].

Several reports on pharmacological properties of *P. hydropiper* L. are available to support the ethnomedicinal uses of the plant including antioxidant, antibacterial, antifungal, antihelminth, antifeedant, cytotoxicity, anti-inflammatory, antinociceptive, oestrogenicity, anti-fertility, anti-adipogenicity, anticholinesterase, and neuroprotection. Toxicological effects of *P. hydropiper* L. are also described. [25].

The nutrients essential for life are proteins, fat and carbohydrates, all contribute to caloric content of the dietary, minerals including trace elements, vitamins and water. Numerous studies including same in man have demonstrated clearly that life may be sustained by nutrient mixtures in which every component is definable chemically and soluble in water [29]. Most of the countries of the world are facing malnutrition problems. The dificiency of protein in human food and animal feed is well recognized. The need of the good quality of protein has been increasing due to rapid growth of population. In addition to increase in conventional production, much work has been done in recent years in developing new chemical and biological methods for the production of protein foods and feeds [27]. This paper deals with the molophology, phytochemical investigation and nutritional values on leaves of *P. hydropiper* L. The aim of current study was to evaluate the bioactive compounds and nutritional values of *P. hydropiper* L.

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Methods

Samples collection, identification and preparation

The specimens were collected from Kyaing Tong Town, Eastern Shan State of Myanmar during September to December, 2018. The collected specimens were identified and described. According to resulting morphological characteristics, the specimen can be identified by the literatures such as Heywood, 1978; Hooker, 1885; Backer, 1946; Lawrence, 1951; Hutchinson, 1967; Cronquist, 1981; Brummitt, 1992; Dassanayake, 1997; Anonymous, 2007; Wu. *et al*., 2010 [1, 3, 5, 8, 9, 15, 16, 18, 21, 32]. The leaves of *Polygonum hydropiper* L. were washed with water and cut into small pieces. Then these samples were air dried in shade at room temperature for one to two weeks. After completely dried, the samples were ground by grinding machine to get powders and stored in air tight containers for further studies.

Phytochemical investigation of the samples

The phytochemical constituents of samples were determined by the methods of British Pharmacopoeia, 1968; Marini Bettalo *et al*., 1981; Central Council for Research in Unani Medicine, 1987; Trease and Evans, 2002 [4, 6, 23, 28].

Physicochemical properties of the samples

For physiocochemical properties, the air-dried powder of leaves were also used. Determination of soluble matter content from various solvents were carried out accordion to British Pharmacopoeia, 1968 and WHO, 1998 [4, 31].

Nutritional analysis of the samples

The nutritional analysis of samples was done at Ministry of Agriculture, Livestock and Irrigation, Small Scale Industries Department, Yangon, Myanmar. The nutritional values were determined by the method following Association of Official Analytical Chemists (AOAC) [17].

Results

Morphological descriptions

Family name : Polygonaceae
Myanmar nane : Phet-phe
English name : Water pepper; smartweed; knotweed
Floweing period : October to December
Part use : Leaves
Polygonum hydropiper L. , Sp. Pl. ed 1, 361.1753.

Annual, sub-erect herbs, 20-80 cm high; stems and branches slender, glabrous; internodes 1.5-2.5 cm long. Leaves simple, alternate; stipules ochreate, tubular 1-1.5 cm long, membranous, distinctly veined with small auricles at the mouth sparsely to densely strigose; petiole 3-8 mm by 1-1.5 mm, sheathing at the base, minutely brownish yellow or black glandular punctate throughout, strigose ciliate; blades lanceolate, 5-6.5 cm by 1-2.5 cm, obtuse at the base, entire along the margin, acute or acuminate at the apex, glabrous on both surfaces except for few hairs on midrib and major lateral veins, lateral vein 7-13 pairs. Inflorescences terminal spikes-like racemes, at ends of branches, with 1 or 2 subsessile flowers in axils of most leaves, raceme very slender, filiform, flexuous, up to 15 cm long, axis minutely glandular. Flowers pink or white, 4-5 mm in diameter, sessile; bracts ochreola, rounded-obtuse to truncate, 1.5-2 mm long, glabrous, ciliate, densely glandular. Tepals 5, free, elliptic, 1.5-3 mm by 1-1.5 mm, imbricate, densely glandular. Stamens 6, inserted; filaments filiform, white; anthers dithecous, minute, basifixed. Ovary unilocular with one ovule on basal placenta; style 2, filiform; stigma simple. Fruits achenial, trigonous, 1.5-2 mm in diameter, dull-brown, minutely punctulate. [Figure 1].

Distribution : Widely distributed from Europe and North Africa to India and Ceylon, and elsewhere in temperate and subtropical Asia to Java; Australia and North America [9]. Kress *et al*. recorded that this species was distributed in Kachin State, Sagaing Division, Shan State and Yangon Division of Myanmar. [20].

Specimen examined : Eastern Shan State, Kyaing Tong Town, Dr. Tin Tin Maw, November 12, 2018.

Uses : Most importantly, *P. hydropiper* L. also has a wide range of tradional uses for medicinal purposes. In Europe, the leaves and seeds are used in a folk medicine against cancer [14]. The use of bruised leaves and seeds as vesicants has also been reported [24]. In India, leaf 's juice is consumed for uterine disorders [7]. In Bangladesh, the Garo tribe uses the leaf juice for menstral pain, the leaf paste to stop bleeding [26]. Another tribe of Tripura uses the mixture of crushed *P. hydropiper* L. leaf with black pepper for headache [13]. The leaf juice has been given for treating many health problems like headache, pain, toothache, liver enlargement, gastric ulcer, dysentery, loss of appetite, and dysmenorrhea [12]. In Vietnam, the stem and leaves are taken for snak-bite and as diuretic and anthelmintic [22]. In Kyaing Tong, native tribes use the young shoot and leaf as spice and garnish with raw fish for its pungent taste. The leaves are taken raw or cooked. It is also used as a spice due to its pungent taste.

A. Habit B. leaves C. Flowering branch D. Infloresence

E. Flower F. Fresh G. Dry leaves

Figure 1. *Mophological characters*

Sensory characters of the samples

The colour of powdered leaves was green. The odour was aromatic. The taste was pungent and slightly bitter. The texture were grandular and fibrous. [Figure 2, Table 1].

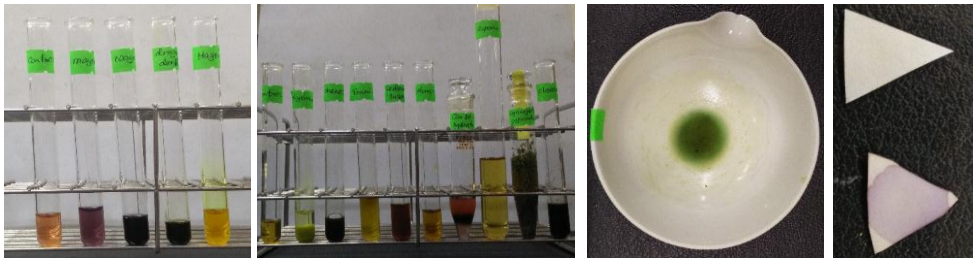
Figure 2. *Powdered leaves*

Table 1. *Sensory characters of the samples*

Characters	Leaves
Colour	Green
Odour	Aromatic
Taste	Pungent, slightly bitter
Texture	Granular, fibrous

Phytochemical investigation

Phytochemical test showed the presence of carbohydrate, glycoside, phenolic compound, α-amino acid, flavonoid, steroid, terpenoid and reducing sugar. Alkaloid, saponin, tannin, starch and cyanogenic glycoside are absent [Figure 3, Table 2].



A. Alkaloid B. Control, glycoside, phenolic compound, tannin, reducing sugar, starch,carbohydrat saponin, cyanogenic glycoside, flavonoid C. Steroid and terpenoid D. Amino acid

Figure 3. *Phytochemical test*

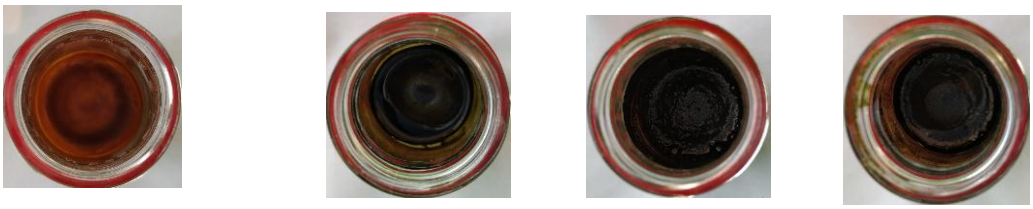
Table 2. Phytochemical investigation of samples

No.	Tests	Extracts	Reagents	Observations	Results
1.	Alkaloid	1%HCL	Mayer's reagent	No ppt	-
			Wagner's reagent	No ppt.	
			Dragendroff's reagent	No ppt.	
			Hager's reagent	No ppt.	
2.	Carbohydrate	H_2O	10% α-naphthol & Conc: H_2SO_4	Red ring	+
3.	Glycoside	H_2O	10% Lead acetate solution	Pale yellow ppt.	+
4.	Phenolic compound	H_2O	5% $FeCl_3$ solution	Greenish black ppt.	+
5.	α-amino acid	H_2O	Ninhydrin reagent	Purple colour	+
6.	Saponin	H_2O	Distilled water	No persistent foam	-
7.	Tannin	H_2O	1% Gelatin & 10% NaCl solution	No ppt.	-
8.	Flavonoid	70% EtOH	Mg ribbon & Conc: HCl	Brownish pink colour	+
9.	Steroid	Petroleum ether	Acetic anhydrate & Conc: H_2SO_4	Bluish green colour	+
10.	Terpenoid	Petroleum ether	Acetic anhydrate & Conc: H_2SO_4	Pink colour	+
11.	Reducing sugar	H_2O	Fehling's solution	Brick red ppt.	+
12.	Starch	H_2O	Iodine solution	Pale brown colour	-
13.	Cyanogenic glycoside	Powder	Distilled water, Conc: H_2SO_4, Sodium picrate paper	No colour change	-

(+) = presence **(-) = absence** **ppt =precipitate**

Physicochemical properties

In physicochemical properties, leaves of *Polygonum hydropiper* L. were found to be more significantly soluble in distilled water and methanol than other solvents. [Figure 4, Table 3].



A. Distilled water B. Ethyl acetate C. Ethanol D. Methanol

Figure 4. Physicochemical test

Table 3. Physicochemical properties

No.	Quantitative determination	Leaves (Average %)
1.	Distilled water soluble content	62.6
2.	Ethyl acetate soluble content	20
3.	Ethanol soluble content	32
4.	Methanol soluble content	55.8

Nutritional analysis

The nutritional analysis revealed the presence of moisture, ash, protein, fat, fiber, carbohydrate, sugar, acidity and energy values. [Table 4].

Table 4. *Nutritional values of samples*

No.	Experiments	Results (%)
1.	Moisture	12.20
2.	Ash	7.65
3.	Protein	17.86
4.	Fat	2.10
5.	Fiber	8.73
6.	Carbohydrate	51.46
7.	Sugar (10% solution)	1.50
8.	Acidity	0.32
9.	Energy value (Kcal/100g)	296.18

Discussion

In this research paper, determination of morphological characters, sensory characters, phytochemical investigation, physicochemical properties and nutritional analysis on leaves of *Polygonum hydropiper* L. were carried out.

In the morphological studies, the plant is annual suberect herbs; leaves simpe, alternate; inflorescences terminal spike-like racemes; flowers pink or white; stamens 6; ovary superior and fruits achenial. [Figure 1]. *Polygonum hydropiper* L. included the IUCN (International Union for the Conservation of Nature) Red list of threatened species 2014 [Website 1].

In sensory characters, the colour of powdered leaves was green. The odour was aromatic. The taste was pungent and slightly bitter. The texture were grandular and fibrous. [Figure 2, Table 1].

In photochemical tests showed the presence of carbohydrate, glycoside, phenolic compound, α-amino acid, flavonoid, steroid, terpenoid and reducing sugar [Figure 3, Table 2]. Carbohydrate will provide energy for human body and brain function. It decrease disease risk; improve the health of digestive system and weight control [Website 2]. Glycoside showed significant antioxidant activity, anticancer and antitumor activity, hepatoprotective activity, anti-inflammatory activity, anti-diabetes activity and antifungal activity [Website 3]. Phenolic compound treat Parkinson' disease, cerebral palsy, sore throat [Website 2]. Amino acid increase muscle growth, decrease muscle soreness and benefit liver disease [Website 4]. Flavonoids are reduced risk of a number of chronic diseases including cancer, cardiovascular disease and neurodegenerative disorders [Website 3]. Steroid can be used treat a wide range of conditions indcluding asthma and chronic obstructive pulmonary disease, hay fever, hive and eczema, painful joints or muscles pain cause by an irritated or trapped nerve-such as sciatica, inflammatory bowel disease-suchs as Crohn's disease, lupus, multiple sclerosis [Website 5]. Terpenoid may help to produce anti-inflammatory,

antibacterial and antidepressant [Website 6]. Reducing sugar promotes weight loss, lower cholesterol level and blood pressure level, reduce inflammation [Website 7].

In physicochemical properties, leaves of *Polygonum hydropiper* L. showed to be more significantly soluble in distilled water and methanol than other solvents [Figure 4, Table 3]. These values can be emplyed for preparation of crude plant drugs.

In nutritional analysis, the leaves contain moisture 12.20%, ash 7.65%, protein 17.86%, fat 2.10%, fiber 8.73%, carbohydrate 51.46%, sugar 1.50%, acidity 0.32% and energy value 296.18 Kcal [Table 4].

Conclusions

According to the results, the morphological characters were recorded for other researchers. Phytochemical investigation contains bioactive compounds which can be used to treat in many diseases. Therefore bioactive compounds should be extracted. In nutritional values, the presence of moisture, ash, protein, fat, fiber, carbohydrate, sugar, acidity and energy value indicated is useful in medicinal properties and nutritious for human health. *Polygonum hydropiper* L. has tremendrous medicinal plant that could be further investigated for the development of evidence-based herbal products. Finally, it is also hope that this research paper will help in improving human health care system of Myanmar.

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