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Morphological and Elemental Analysis of *Cyathulaprostrata* (L.) Blume using Atomic Absorption Spectroscopy

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ABSTRACT

Cyathulaprostrata (L.) Blume. is a herb or under shrubs belongs to the family Amaranthaceae. It grows in loamy and sandy soils. It is commonly called small prickly chaff flower or pastures weed. It is used as a medicinal plant as well as food. The present study includes the morphological and elemental analysis of *Cyathulaprostrata* (L.) Blume. *Cyathulaprostrata* (L.) Blume consist of opposite, petiolate and entire leaves, with very small hermaphrodite flowers with bracts and bracteoles. The inflorescence is a raceme or a spike. The perianth of perfect flowers are scarious and five lobed. It has five stamens with filaments connate at the base. It has two celled anthers, obovoid and one celled ovary with a solitary ovule, simple style with capitulate stigma. The fruit is a membranous utricle enclosed in a perianth. The elemental composition of *Cyathulaprostrata* (L.) Blume. Leaves have been determined by using atomic absorption spectroscopy. Elements such as Ca^{2+}, Fe^{2+}, Mg^{2+}, Mn^{2+}, Na^{2+}, Zn^{2+}, Cd^{2+}, Cr^{2+}, Pb^{2+}, Ni^{2+}, Cu^{2+}, Ag^{2+} were determined. The result of analysis showed that calcium has the highest concentration, which helps to build bones and keeps them healthy and also helps in blood clotting, muscle contraction, heart beat etc. The plant also contains other essential elements like iron, magnesium, manganese etc. The toxic metals like lead and cadmium also present in trace amount. The purpose of this study is to analyze the morphology, pharmacological potential and composition of elements in *Cyathulaprostrata* (L.)Blume.

Key words: *Cyathulaprostrata, Amaranthaceae, Atomic Absorption Spectroscopy.*

Introduction

Cyathulaprostrata (L.) Blume. is commonly found as a weedy herb. It is used as a medicinal plant and as a food. It is an herb or under shrub. Herbal medicines have better compatibility with human body and have lesser side effects (Kamboj, 2000). It has various medicinal application in the field of Ayurveda, Unani and Sidha (Malaya *et al*., 2004). *Cyathulaprostrata* (L.) Blume. is a herbor under shrub belonging to the family Amaranthaceae. It is commonly known as small prickly chaff flower or pastures weed. Leaves of *Cyathulaprostrata* (L.) Blume. is opposite, entire with small hermaphrodite flowers with bracts and bracteoles. Fascicles with 1-2 perfect flowers and others imperfect, Inflorescence is racemes or spikes. Perianth of perfect flowers scarious and five lobed, the lobes are acuminate with hooked awns. Stamens five with filaments connate below in a hypogynous membranous cup. Anthers are two celled. Ovary is obovoid and one celled with solitary ovule. Style is simple with capitulate stigma. Fruit of *Cyathulaprostrata* (L.) Blume is an ovoid membranous utricle, which is enclosed in a perianth

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which has an areolate apex.

Atomic absorption spectroscopy is a spectro analytical procedure of the quantitative determination of chemical elements using the absorption of optical radiation by the free atoms in the gaseous state. The main objective of the present study is the morphological and elemental analysis *of Cyathulaprostrata* (L.) Blume. using atomic absorption spectroscopy. The present study reveals the medicinal potential of the plant *Cyathulaprostrata* (L.) Blume.

Materials and Methods

The study area

Cyathulaprostrata (L.) Blume plants were collected from Kasaragod district of Kerala. The district lies between 110 18' and 120 48‘ north latitudes and between 740 52‘ and 750 26‘ east longitudes.

Study method

The vegetative and floral morphology were done from the field itself and details were noted in the field book after analyzing the species. The sample specimens were collected and identified using “Flora of Presidency of Madras Volume II by James Sykes Gamble. The element present in the plant was analyzed through atomic absorption spectroscopy. The plants were washed and dried in the shade. Test method used was Association of Analytical Chemical International 21st Edition 2019(3.2.05). Samples are stored in tight sealed pack. The whole sample is mixed well and a portion is blended to fine powder.1 to 3 grams of well ground mixed sample is weighted into a pre weighed crucible and heated for overnight at 500 ^{0}C and let cool. Wet ash with ten drops of water and one to two milli litre nitric acid. Evaporate excess nitric acid on a hot plate set approximately 100 ^{0}C. Ash is dissolved in 10 ml HCL, filter to volumetric flask and made up to 10 ml with distilled water. Read the concentration by aspirating sample and reference standard solution in atomic absorption spectroscopy. The most of the atoms for elemental analysis cannot exist in the free, ground state at room temperature and therefore heat must be applied to the sample to break the bonds combining atoms in molecules. The mixture is ignited in a flame of temperature ranging from 2100 to 2800^{0}C. During combustion, atoms of the element of interest in the sample are reduced to atomic state. The Perkin Elmer Lambda 45 atomic absorption spectrometer was used to record the spectra. The liquid sample is fed into flame via a nebulizer where the sample is converted into atom at approximately 2300 ^{0}C. The radiation from the cathode lamp passes through the flame. The radiation that reaches the detector is then measured to the intensity of the radiation that hit the detector when the sample was not present. Then processor calculates the results obtained by the detector and the amount is outputted on the display screen. The characteristic wavelengths are element specific and accurate to 0.01-0. 1nm.

Results and Discussion

The leaves of *Cyathulaprostrata* (L.) Blume. contains various important metals like copper, iron, calcium, chromium, nickel, sodium, cadmium, Lead, manganese, silver, magnesium and zinc. The present study indicates the presence of calcium is 286 mg/100 g is greater than that of the other metals. Calcium helps in the building of bones, blood clotting, muscle contraction, heart beat etc. The deficiency of Calcium creates several problems such as muscle cramps, lethargy, poor appetite, weak or brittle fingernails, difficulty in swallowing, fainting etc. The Dietary Value for Calcium is 1,300 mg for children aged four years and adults (U.S. Food and Drug Administration, 2016)

The concentration of Iron in *Cyathulaprostrata* (L.)

Table 1. Chemical analysis of *Cyathulaprostrata* (L.) Blume. Leaves by atomic absorption spectroscopy by A.O.A.C. International 21st edition 2019 (3.3.05) method

Sl. No.	Parameters	Results mg/100g
1	Copper (Cu)	0.5
2	Iron (Fe)	53.3
3	Calcium (Ca)	286
4	Chromium (Cr)	0.3
5	Nickel (Ni)	0.5
6	Sodium (Na)	8.4
7	Lead (Pb)	0.3
8	Cadmium (Cd)	0.1
9	Manganese (Mn)	13.3
10	Silver (Ag)	0.02
11	Magnesium (Mg)	26.9
12	Zinc (Zn)	1.6

Please note that each result is an average of at least three independent measurements with a precision of about ± 1%.

Blume. is 53.3 mg/100 g. The rich Iron and calcium content help to build a healthy body and helps to avoid anemia like disease (FAO/WHO, 2004). The amount of Magnesium present in this plant is 26.9 mg/100g. Magnesium plays an important role in human body to maintain cholesterol levels, heart rhythm, and it converts blood sugar in to energy and also prevents headaches and attention deficit hypersensitivity disorder (Bahadur *et al*., 2011). Manganese deficiency produces severe skeletal and reproductive abnormalities in mammals (Mapandu, *et al.,* 2005). The amount of manganese is 13.3mg/100g in *Cyathulaprostrata* (L.) Blume.

Sodium content in this plant is 8.4 mg/100 g. Sodium helps to keep the water and electrolyte balance of our body. Zinc content in *Cyathulaprostrata* (L.) Blume.1.6 mg/100 g. It is basic component of a large number of different enzymes and plays structural, regulatory, and catalytic functions (Underwood, 1971). It is important in DNA synthesis, normal growth, brain development, bone formation, wound healing etc.

Chromium concentration in *Cyathulaprostrata* (L.) Blume is 0.3 mg/100 g. It plays a vital role in the metabolism of cholesterol, fat, and glucose. Its deficiency cause hyperglycemia, elevated body fat, and decreased sperm count, while at high concentration it is toxic and carcinogenic (Chishti *et al.,* 2011.) The concentration of copper in *Cyathulaprostrata* (L.) Blume. is 0.5 mg/100g. WHO's permissible limit of copper in medicinal plants is 10 mg/kg, while its intake in food is 2-3 mg/day (WHO, 2005). Together with Iron, copper enables the body to form red blood cells and helps to maintain healthy bones, blood vessels, nerves, and immune function. Adequate Copper in the diet may help to prevent cardiovascular disease, osteoporosis etc. Nickel facilitates ferric iron absorption (Underwood, 1971). Rats deprived of nickel exhibited retarded growth, low hemoglobin, and impaired glucose metabolism ((WHO, 2005). The concentration of nickel in *Cyathulaprostrata* (L.) Blume is 0.5 mg/100 g. *Cyathulaprostrata* (L.) Blume contain toxic metals like lead and cadmium. Cadmium concentration is 0.1 mg/100 ml and the amount of lead is 0.3 mg/100g.

The botanical source of large number of folk medicines found the rapeutically effective in indigenous systems are still unknown. From the present study it was concluded that *Cyathulaprostrata* (L.) Blume can be preferred to consume by humankind and can be utilized for various medicinal purposes. It is really essential to evaluate and identify the nutrient and medicinal propertiesof this less explored plant at various levels.

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Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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