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ANALYTICAL INVESTIGATION OF INORGANIC NUTRITIVE ELEMENTS OF CAPPARIS DECIDUA GROWN IN CHOLISTAN DESERT

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Capparis decidua is commonly used for the cure of different diseases in indigenous medicine. A study was conducted to determine the concentration of Na^{+}, K^{+}, Ca^{+2}, Mg^{+2}, Fe^{+3}, PO_4^{-3}, SO_4^{-2}, CO_3^{-2}, HCO_3^{-} and Cl^{-} in Capparis decidua grown in Cholistan desert. The purpose of this research was to study variation in the concentration of nutrient ions found in different parts of plant and local soil habitat. In some locations, nutrients were found higher in soil than the plant parts. Generally, the nutrient levels were found higher in flowers, barks and soils respectively. The baseline data generated will be helpful for 'Hakims' in the preparation of 'Unani medicines'.

Keywords: Cholistan desert, Medicinal plants, Nutritive elements/ions

1. Introduction

Geotropical environment is an important factor for the nutritive content of a particular medicinal plant. In developing countries, alternative medicines could help to solve many of the common as well as peculiar medicinal problems facing the people. The distribution of elements in various parts of a particular plant will highlight the distribution of certain useful trace elements and their availability from specific part of medicinal plants [1, 2]. Among the vegetation of Cholistan desert, the Capparis decidua is the focus of current study.

Besides water, plants contain inorganic nutrients from the soil for their metabolic activities. Some of the heavy metals are essential in trace amounts and play an important role in plant and animal nutrition, enzymatic reactions and metabolic processes [3, 4]. The metals like Cr, Fe, Mn, Zn, Mo, Co, Cu and Ni are essential for higher plants and animals [5, 6]. The sensitivity of plants and animals differs strongly for deficiency and excess levels of a particular metal. Even among various species of plants and animals, it is very difficult to establish a single critical value of deficiency or potential toxicity of a particular metal [3, 7]. The availability of heavy metals depends upon soil properties such as pH, electrical conductivity, lime content, organic matter and texture. Therefore, their correlation studies are of utmost importance. For healthy growth of plants, phosphorus, potassium, nitrogen sulpher, calcium, iron and magnesium are essential nutrients. These elements together with carbon, hydrogen, and oxygen were looked upon as ten essential elements [8 – 11].

1.1. The Cholistan

Around 4000 B.C. Cholistan was a cradle of civilization commonly known as the Hakra Valley civilization. Hot, arid and sandy Cholistan desert is an extension of Great Indian Desert with length of about 480 km and width of from 32 to 192 km. This desert is comprised of about 26 million hectares. The mean annual rainfall is about 100 mm to 200 mm. Mean minimum and maximum temperatures are 20 °C and 40 °C respectively. The Cholistan was formed by deposition of aeolian sands or alluvium deposits. The alluvium deposits are disintegration products of granites, schists, states and gneiss. The soil of Cholistan is generally

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saline, alkaline and gypsiferous [12, 16, 17].

1.2 Agroecology

Capparis decidua belongs to Capparis deceae family, locally named as “Kari” or “Karir” and is widely distributed in dry areas of Punjab, Rajastan extending into dry areas of the peninsular India, Sindh, Balochistan, Gujrat, Saudi Arabia, Egypt, Sudan, East and South Africa, North and Tropical Africa. Sometimes in dense stands, it prefers loamy clay and is very drought resistant [18, 19].

1.3 Pharmacological importance

The fresh growing barks, flowers and green fruits of Capparis decidua are used in the preparation of commodities. However, common man in rural areas eats ripened sweetish fruits. Poor people also use the sweetish juice of ripe fruit as an alternative source of sugar. In Cholistan, the floral buds are cooked as delicious vegetables; ripened seeds are boiled with water, dried and preserved to be used later as vegetable. The young twigs serve as fodder for cattle and goats [20, 21].

Different parts of the plant (Capparis decidua) are being used by traditional hakims in the preparation of Unani medicine. It is used for the treatment of asthma, cough, vomiting, piles, ulcer, boil swellings, urinary disorders, antidote to poison, cardiac ailment, and infection of joints. The juice of the fresh plant is dropped into the ear to kill worms. A pickle is made with the unripe fruits of this plant, which is also used in various diseases. The bark has an acidic taste, analgesic, diaphoretic, alexeteric, laxative, anathematic, good in cough and asthma, ulcers and boils, vomiting, piles and in all inflammations. The fruit has a sharp taste, destroys foul breath, biliousness, urinary purulent discharges, good in cardiac disorders [22]. In Punjab, top shoots are made into a powder and used as a blister; they are also used in boils, eruptions, and infection of joints and swellings and as an antidote to poison. Shoot bark is also very effective in relieving toothache when chewed [12, 22, 24].

A survey of the literature shows only scanty reports on the inorganic chemical composition of Capparis decidua grown in Cholistan desert. The present investigation was undertaken to assess by chemical analysis, the nutritive values of the flowers, bark and unripe fruits of the plant.

2. Materials

During this study, 5 to 7 samples of each soil bark and flowers of Capparis deciduas were collected from three different sites of ‘Baghdad-ul-Jadeed campus’; Islamia University Bahawalpur, located in Cholistan desert (Table 1). The samples were analysed for different cations and anions like Na^{+}, K^{+}, Ca^{+2}, Mg^{+2}, Fe^{+3}, PO_4^{-3}, SO_4^{-2}, CO_3^{-2}, HCO_3^{-} and Cl^{-}, using different methods [12, 13, 15].

2.1. Chemical reagents

All the reagents and chemicals used were of AR grade. All the solution of standards and samples were prepared in deionised water.

2.2 Plant sample preparation

The plants were cleaned visually to remove the dust particles and dried at 150°C to a constant weight. The dried plants were grinded to fine powder and then used for dry ashing. The pre-cleaned silica crucible was heated at 600°C to a constant weight. The powdered plant material in the crucible was heated in a muffle furnace at 600°C until there was no evolution of smoke. The crucible containing plant ash was cooled at room temperature and moistened with deionised water to keep it overnight. The undissolved particles were

Table 1. Site location for samples of Capparis decidua collected from Cholistan Desert Area of Baghdad-ul-Jadeed Campus, Islamia University, Bahawalpur.

Site Code	Sample Location
A	Samples collected from Engineering Department, Baghdad-ul-Jadeed Campus Islamia University, Bahawalpur.
B	Samples collected from Green Belt, Baghdad-ul-Jadeed Campus Islamia University, Bahawalpur.
C	Samples collected from Main roadside of Baghdad-ul-Jadeed Campus Islamia University, Bahawalpur.

Table 2 Levels of nutritive elements / ions in 'Capparis decidua' of Cholistan desert (ppm)

Sample nature / Site		Na^{+}	K^{+}	Ca^{+2}	Mg^{+2}	Fe^{+3}	PO_4^{-3}	SO_4^{-2}	CO_3^{-2}	HCO_3^{-1}	Cl^{-1}
A	Soil	40	400	78	50.2	268	6.1	864.5	0.2	1.1	1065
	Bark	50	3000	288	9.60	435	1.8	9.600	0.6	2.8	568
	Flower	25	1000	104	38.4	201	5.0	82.100	0.5	2.5	284
B	Soil	35	10	48	9.60	335	2.5	28.90	8.4	4.5	426
	Bark	15	4000	216	9.60	603	3.5	864.50	16.4	6.2	1420
	Flower	30	1500	104	33.6	234	2.7	705.10	6.2	3.4	213
C	Soil	5	16	40	19.2	201	2.5	50.00	10.0	7.0	497
	Bark	10	4000	64	28.8	234	3.3	88.620	13.4	8.0	1207
	Flower	25	1500	72	24.0	268	3.8	772.80	8.0	7.5	497

* Average Values (n=4), Confidence interval at 95%

filtered and the volume was made upto one liter. This solution was used as sample solution.

2.3 Soil Sample Preparation

20 g of dried soil was taken in a 500 ml beaker, stirred with 100 ml deionised water for 30 minutes and filtered through 'Whatman 42' filter paper. The volume of the filtrate was made upto one liter and is used for quantitative estimation of Na^{+}, K^{+}, Ca^{+2}, Mg^{+2}, Fe^{+3}, PO_4^{-3}, SO_4^{-2}, CO_3^{-2}, HCO_3^{-} and Cl^{-}.

3. Methods

Sodium and potassium were determined by flamephotometer model 'Corning - 40. Calcium and magnesium were determined by complexometric titration with EDTA. Iron was determined by oxidation-reduction titration. Phosphates were determined by calorimetric method using 'ammonium dihydrogen phosphate' as standard solution and 'molybodate' as complexing agent. Sulphates were estimated gravimetrically. Carbonates and bicarbonates were determined by titrimetric method and chlorides were determined by argentometric titration [12 - 15].

4. Results

4.1 Site – 'A' Samples.

Soil of Capparis decidua collected from site-A (Table 2) has the high concentration of potassium than the concentration of sodium and plant from the soil picks up the less amount of sodium. The bark of Capparis decidua of site-A has 55 ppm sodium. The plant samples (bark and flower) have high concentration of potassium i.e. 3000 ppm and 1000 ppm respectively. It is due to the reason that cell of some plants are designed in such a manner by the nature that they have a tendency to pick up more potassium than sodium, just like the case of cauliflower in which histidine (amino acid) is specifically designed for complexation with nickel ions [25, 26].

The maximum level of calcium is noted in bark i.e. 288 ppm and magnesium in flowers i.e. 38.4 ppm when compared with their soil sample i.e. 78 ppm and 50.2 ppm respectively. Contents of iron are maximum in the bark of Capparis decidua i.e. 435 ppm as compared to the soil i.e. 268 ppm. Soil collected from site-A has high concentration of anions like chloride, phosphate and sulphate i.e. 1065 ppm, 6.1 ppm, 864.5 ppm respectively as compared to the plant bark which pickled less amount of these contents.

4.2 Site – 'B' Samples.

Soil collected from site-B (Table 2) has high concentration of sodium i.e. 35 ppm than the plant. So less amount of sodium is picked up by the plant. The level of potassium in the bark and flower of Capparis decidua is much higher i.e. 4000 ppm and 1500 ppm as compared to the soil i.e. 10 ppm. Calcium and magnesium concentrations are higher in the plant bark and flower i.e. 216 ppm and 33.6 ppm respectively as compared to their soil.

The level of chloride in the soil of site-B is 426 ppm. It is observed that concentration of chloride in this soil is in lower amount than in bark and flowers i.e. 1420 ppm and 213 ppm respectively. The maximum concentration of phosphate and sulphate are noted in the bark i.e. 3.5 ppm and

864.5 ppm respectively as compared to the soil i.e. 2.5 ppm and 28.9 ppm respectively.

4.3 Site – 'C' Samples.

Soil collected from site-C (Table 3) showed low concentration of sodium and potassium as compared to plant bark and flower, which have maximum concentration. The concentration of calcium is low in soil i.e. 40 ppm as compared to bark of Capparis deciduas i.e. 64 ppm. Much iron contents are observed in flowers and bark i.e. 268 ppm and 234 ppm respectively as compared to soil, which have low concentration i.e. 201 ppm.

Maximum amount of chloride is noted in the bark of site-C i.e. 1207 ppm as compared to soil, which shows no significant difference i.e. 497 ppm. Level of carbonate and bicarbonate are higher in bark and flower of Capparis decidua than soil. The overall high concentration of bicarbonate in samples collected from main road side of the campus is a kind of sign that global warming is increasing because of the excessive burning of the fossil fuel or plants, so that the plants have high concentration of bicarbonates [4].

5. Discussion

Sodium and potassium salts are the electrolytes and sodium is the major component of the cation of extra cellular fluid while potassium is the cation of intracellular fluid. 139 meq / liter of sodium and 5 meq / liter of potassium is present in blood plasma of human beings [4]. Both sodium and potassium control the osmotic pressure including water retention. High concentration of sodium leads to hypertension while the high concentration of potassium leads to the dilation of arteries and normalize the blood pressure. Excessive amount of potassium leads to heart failure [26, 27]. Capparis deciduas have high potassium intake parallel to that of low sodium. The concentration of calcium in the Acacia nilotica is greater than magnesium because it performs the number of functions by the chelation phenomenon. 5 meq / liter of calcium is present in blood plasma of humans [4, 12]. Magnesium only is being sufficient for the chlorophyll, which is the central metal atom of porphyrin ring in chlorophyll [4, 26].

Chloride is essential in water balance, osmotic pressure regulation as well as acid base equilibrium [4]. Concentration of chloride studied in Capparis decidua is higher than concentration of carbonates and bicarbonates. Concentration of sulphate is greater than phosphate in Capparis decidua. Organic sulpher is mainly oxidized to sulphate and excreted as inorganic Sulphate. Most of phosphate may be combined with calcium in bones and teeth. In the plant sample, collected from different habitat showed high concentration of iron. Iron is the central metal atom of hemoglobin and Fe^{+2} only fit in the porphyrin ring. Most of iron in foods occurs in Fe^{+3} state as in case of spinach. Iron deficiency causes the anemia disease. Anemic patients should be given iron rich substances to overcome this problem. For the cure of anemia and jaundice, 'Geru'; a soil rich in iron oxide, having a reddish colour, mainly found in Rajastan (India), was used by local people i.e. Hakeem and Ved [4, 10, 22,].

Abnormalities of sodium metabolism are generally accompanied by abnormalities in chloride metabolism when sodium loss takes place in excessive amount as in diarrhea, chloride deficiency likewise is observed. Sodium and chloride has equal concentration in blood plasma of human beings [9 – 11]. If a person gets sunstroke or heatstroke, the body loses the sodium and potassium and there will be disturbance and unbalancing of electrolyte in the body. To compensate or normalize it, oral rehydration salt (ORS) is given to the patient. Capparis decidua barks, containing high concentration of sodium, potassium and chloride used in medicine, act as remedy for diarrhea.

Capparis decidua has high amount of chromium and zinc i.e. 12.86 mg / 100 g and 2.83 mg / 100 g. So it might be used as a remedy for diabetes and water retention [20]. The fruit of Capparis deciduas, commonly called "Dela" is slightly bitter in taste and often pickled. Bitter taste plants, fruits and vegetables are commonly used as remedy for diabetes because of high concentration of chromium and zinc. Their deficiency may cause diabetes. Capparis deciduas might be used for the cure of diabetes [20, 21, 28].

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