Available online www.scholarsresearchlibrary.com

Scholars Research Library
***J. Nat. Prod. Plant Resour.*, 2016, 6 (5): 1-4**
(http://scholarsresearchlibrary.com/archive.html)

Studies on nutrient status in the wild and cultivated medicinal plants of the family lamiaceae

***Kamatchi kala Balasubiramanian**

Department of Botany, Sri Parasakthi College for Women, Courtallam, Tirunelveli, India

---

ABSTRACT

Four medicinally important species namely; Anisomeles malabarica, Hyptis suaveolens, Leucas aspera and Ocimum americanum belong to the family of Lamiaceae were collected from Maravanmadam, Tuticorin, Tamilnadu in India and analysed for inorganic ions content. The nutrient status was determined in both cultivated (Pot grown) and wild plant species. Soils collected from the field and pots were also analysed for inorganic ions content. The concentration of ions such as K^+, Ca^{2+} and Mg^{2+} except Na^+ were found to be more in leaves of cultivated plants. The ratio of K^+/ Na^+ was also found to be more in cultivated samples. The concentrations of above mentioned ions content were also found to be higher in the soil samples collected under the cultivated plant species.

Keywords: Lamiaceae, Inorganic ions, Pot grown, wild plant, soil sample.

INTRODUCTION

Reasons such as efficacy, safety, non-toxic, low cost and less side effects are increasing our demand on herbal medicine. Cultivation of medicinal plants can be good alternative to meet the growing demand. People in developing countries have already started growing them in their gardens for use as home remedies. There are several physiological factors have significant effect on the growth and yield of medicinal plants. Among them, mineral nutrients play a crucial role as their deficiency greatly influences the growth, metabolism and medicinal properties of the plant.

The Medicinal plant contains trace elements which have an impact on its pharmacological action. Study of elements with respect to indigenous medicinal plants reveal that major and trace elements have significant roles in combating variety of human ailments and diseases [1]. Mineral composition of a plant plays significant role in nutritional, medicinal and therapeutic values [2,3]. Hence, a steady and careful application of mineral nutrients is essential to improve the economic yield as well as the content of secondary metabolites, and chemical constituents of medicinal plants under normal and adverse growing conditions.

The quality and efficacy of the biologically active components in medicinal plants are closely linked to the soil and atmosphere which nourish the plant. When plants are growing in mineral rich soil the quality and quantity of chemical compounds or bio-active substance will be high. Active constituent of medicinal plants are metabolic products of plant cells and a number of trace elements play an important role in the metabolism [4]. The estimation of elemental composition of the widely used medicinal plants is highly essential to improve their quality and efficacy.

In the present study, an attempt was made to analyze the nutrient status in the wild and cultivated medicinal plants of the family Lamiaceae. The following plants selected for the present study have been used in various ailments.

***Anisomeles malabarica* (L.)** is a medicinal plant has been used as a folkloric medicine to treat amentia, anorexia, fevers, swellings, rheumatism [5]. The herb is reported to possess anticancer, allergenic, anthelmintic, antiallergic,

antianaphylactic, antibacterial, anticarcinomic, antiedemic, antihistaminic, antiinflammatory, antileukemic, antinociceptive, antiplasmodial, antiseptic and antiperotic properties [6].

***Hyptis suaveolens* (L.Poit)** is stimulant carminative, antiplasmodic, antirhenmatic, antisuportic bath. It is also used for headache, Stomach ache and snuff to stop bleeding of the nose [7].

***Leucas aspera* (willd). Linn** is used traditionally as an antipyretic and insecticide. Flowers are valued as stimulant expectorant, aperients, diaphoretic, insecticide and emmenagogue. Leaves are considered useful in chronic rheumatism, psoriasis and other chronic skin eruptions. Bruised leaves are applied locally in snake bites [8, 9].

***Ocimum americanum* L.** is carminative, diaphoretic and stimulant; used in cold, coughs, catarrh and bronchitis, Leaf juice is used for dysentery and as a mouth-wash for relieving toothache; poured into nostrils for migraine. Decoction of the leaf is used for checking nose bleeding and malarial fever. Leaf paste is used as a cure for parasitical skin diseases. Tea or infusion of the leaf is used in fever, indigestion and diarrhoea. The main uses of *Ocimum americanum* are antimicrobial, antioxidant, anthelmintic and anti-diabetic [10].

RESEARCH METHODS

Collection of plant materials

The above said four medicinal plant species were collected from the wild area near Maravanmadam, Tuticorin, Tamilnadu, India. Their seeds were collected carefully and it was germinated in the pots with good garden soil and irrigated properly. The leaves collected from wild and potted cultivated plants were shade dried and ground to coarse powder with the help of electrical grinder and stored in air tight pocket for further analysis.

Determination of K^+, Na^+, Ca^{2+}, Mg^{2+}

Exactly 500mg of powdered dry plant samples were weighed in to 75ml digestion tubes containing ternary mixture (10ml HNO_3 + 4ml Kclo + 1ml H_2So_4) of acids. The digestion tubes were placed on a digester (Model Gerhardt, West Germany) until the acid mixture became colorless. The tubes were removed and allowed to cool. 20ml of deionized water was added to each digestion tube. The contents were filtered through Whatman No-42 filter paper in to acid washed (1N HNO^3) 10 ml polythene bottles. After filteration, solution was made up to 100ml using deionized water and bottles containing the samples were stored for analysis.

Elemental analysis was performed using flame atomic absorption spectrometry (Perkin Elmer 5000, U.S.A). Prior to calcium, potassium and magnesium analysis lanthanum chloride (matrix modifier) was added [11] to sample solution to avoid interaction from other elements during analysis.

Soil collection and analysis

To study the chemical variation in the plant growing under field and cultivated conditions, soil from both conditions was collected near the plants with depth about 0-10cm. Soil collected from the field and pots were stored carefully in plastic bags for the analysis of inorganic ions. K^+, Na^+, Mg^{2+} and Ca^{2+} were determined by atomic absorption spectrometry using appropriate lamps (Perkin Elmer 5000, U.S.A). Digestion and analysis were as in plant samples. The amount of soil was 1g. During digestion of the soil samples in the ternary mixture of acids (10mlHNO_3 + 4ml$KClo_4$ + 1ml H_2So_4) instead of 1ml H_2So_4, 1ml of HCL was added.

RESULTS AND DISCUSSION

Table 1 presents the data on mineral elements of all the four plant samples from both (Wild and Cultivated) Conditions. The sodium content in wild and cultivated plant samples ranged from 4.52 mg g^{-1} to 6.92mg g^{-1}; 3.98 mg g^{-1} to 5.95 mg g^{-1} respectively.

The concentration of sodium was found to be low in all cultivated samples as compared to wild samples. Soil salinity could be a factor for accumulation of high amount of Na in wild samples. The high Na content inhibits activity of many enzymes. This inhibition is dependent on how much potassium is present: a high sodium/potassium ratio is the most damaging [12].

Among the mineral elements, the concentration of potassium was found to be high in both wild and cultivated plant samples, ranged from 8.4 mg g^{-1} to 14.8 mg g^{-1}(in wild) 10.2 mg g^{-1} to 18.9 mg g^{-1}(in cultivated). Potassium has

highest concentration in the leafy materials than any other nutrients as it is an activator of some enzymes [13]. It plays critical role in maintaining cell turgor, membrane potential and enzyme activities.

Calcium concentration varied from 2.5 mg g^{-1} to 4.2 mg g^{-1}(in wild) and 4 mg g^{-1} to 6.4 mg g^{-1} (in cultivated). The amount of Mg in wild and cultivated plant samples ranged from 6.2 mg g^{-1} to 8.4 mg g^{-1}; 15.7 mg g^{-1} to 18.7 mg g^{-1} respectively. Magnesium content showed big difference in the investigated samples. These difference could probably be the result of plant nutrition, climate and soil condition [14]. High content of Mg in plants could be related to temperature [15].

It was observed that K/Na ratio varied from 1.8 to 2.3 (in wild) and 2.6 to 3.9 (in cultivated). A significant difference was found between sodium and potassium in both wild and cultivated plant samples. It is important to mention that the regulation of potassium is intimately involved with that of sodium and both are largely interdependent.

The analysis of mineral elements in both the plant samples (wild and cultivated) revealed that all the nutrients such as K, Mg and Ca except Na were found to be higher in cultivated samples as compared to wild plant samples.

The concentration of all the studied mineral elements varied in both (wild and cultivated) sampled. The difference in the concentration of elements might be due to absorbability of plants, use of fertilizer, irrigation water and mineral composition of soil in which the plants are cultivated[16,17].

Table 2 presents the data on nutrient status in soil samples collected beneath the wild and cultivated plant samples. The concentration of minerals such as potassium, Magnesium and calcium were found to be more in soil samples collected beneath the cultivated plant samples. The high levels of these nutrients helped the domesticated plant to grow well. Sodium contents were higher in soil collected near wild plants than in garden soil. Na is the predominant soluble cation in most saline soils and water particularly in coastal area. High amounts of sodium disturb Potassium nutrition and when accumulated in cytoplasm, inhibit many enzymes [18].

Table 1: Concentration of ions (mg g^{-1} DW) in the leaves of wild and cultivated medicinal plants

Nutrients	*Anisomeles malabarica*		*Hyptis suaveolens*		*Leucas aspera*		*Ocimum americanum*	
	Wild	**Cultivated**	**Wild**	**Cultivated**	**Wild**	**Cultivated**	**Wild**	**Cultivated**
Na^+	6.92±0.15	5.25±0.02	6.5±0.25	5.95±0.29	5.88±0.02	4.25±0.01	4.52±0.12	3.98±0.45
K^+	12.45±0.25	18.85±0.13	14.8±0.78	18.9±0.15	13.75±0.02	16.5±0.03	8.4±0.6	10.2±0.6
$Ca2^+$	3.9±0.5	6.4±0.8	4.2±0.26	5.5±0.02	4.0±0.02	4.8±0.02	2.5±0.1	4.0±0.02
Mg^+	8.4±0.25	15.7±0.75	8.2±0.15	17.5±0.25	6.8±0.5	18.3±0.7	6.2±0.6	18.7±0.2
$K+/Na^+$	1.8	3.6	2.3	3.2	2.3	3.9	1.9	2.6

Values are means of ± SE (N=3)

Table 2: Concentration of ions (mg g^{-1} DW) in soil samples collected beneath the wild and cultivated plants

Nutrients	*Anisomeles malabarica*		*Hyptis suaveolens*		*Leucas aspera*		*Ocimum americanum*	
	Wild	**Cultivated**	**Wild**	**Cultivated**	**Wild**	**Cultivated**	**Wild**	**Cultivated**
Na^+	14.75±0.25	8.28±0.12	15.3±0.29	9.05±0.15	17.45±0.12	7.95±0.35	14.28±0.15	8.15±0.05
K^+	16.15±0.12	21.75±0.20	16.0±0.01	20.25±0.8	17.85±0.25	20.7±0.05	16.27±0.29	19.2±0.01
$Ca2^+$	6.8±0.15	15.5±0.10	6.5±0.25	16.2±0.25	7.28±0.02	15.8±0.02	5.4±0.02	14.5±0.2
Mg^+	12.6±0.25	27.5±0.95	14.7±0.02	28.0±0.05	10.4±0.8	25.3±0.04	9.5±0.5	25.5±0.45
$K+/Na^+$	1.1	2.6	1.04	2.2	1.02	2.6	1.1	2.4

Values are means of ± SE (N=3)

The K/Na ratio is low in all the soil samples taken near the wild plant. The wild plants get water through rains. In recent years, very low rainfall has been recorded in the study area. This may be one of the reasons for the low K/Na ratio. The difference in the garden soil and soil collected near the wild plants is highly relevant. The composition of plant is mainly dependent on the soil on which the plants are grown.

CONCLUSION

The present study attempts to draw attention of the people interested in cultivation and utilization of medicinal plants throughout the world. Mineral nutrients are indispensable for the growth and development of plants as their deficiency limits crop production significantly. The concentration of ionic contents in cultivated plants was higher compared to the wild plant. The presence of high concentration of mineral elements could certainly have significant effect on the herb quality and efficacy. Hence, it is concluded that the cultivated medicinal plants also hold great promise in providing variable secondary metabolites and minerals that could enhance the healing power of ill health.

REFERENCES

[1] Shirin, K Imad S, Shafiq S. and Fatima, K. Determination of major and trace elements in the indigenous medicinal plant Withania somnifera and their possible correlation with therapeutic activity. Journal- of-Saudi-Chemical- Society, 2010, 14: 97-100.
[2] Choudhary, M.I and A.Rehman. Recent Discoveries in Natural Products Chemistry, 7th EURASS, A conference on chemical sciences, HEJ-Research Institute of chemistry, University of Kerachi, Pakistan, 2002, p: 25.
[3] Al-Kharusi, L.M., Elmardi, M.O., Ali, A., Al-Said, F.A.J., Abdelbasit, K.M. and Al-Rawahi, S. Effect of mineral and organic fertilizers on the chemical characteristics and quality of date fruits. International Journal of Agriculture and Biology, 2009, 11: 290-296.
[4] Rajurkar, N. S. and Damame NM. Mineral content of medicinal plants used in treatment of diseases resulting from urinary tract disorders. Biological Trace element Research, 1998, 65: 251-259.
[5] Chopra, R.N, Nayar S.L, and Chopra, I.C. Glossary of Indian Medicinal Plants. Counsil of Scientific and Industrial Research, New Delhi, 1956, 19.
[6] Jeyachandran R., Mahesh A. and Cindrella L. International Journal of Cancer Research, 2007, 3(4): 174-179.
[7] Nadkarni K.M. Indian Materia Medica. Mumbai, India, Popular Pakistan, 1976, p: 671.
[8] Rai.V, Agarwal.M, Agnihotri.A.K, Khatoon.S, Rawat AK, Mehrotra.S. Pharmacological evaluation of Leucas aspera. Natural Product science Applied Radiation and Isotopes, 2005.
[9] Shirazi, A.M. Studies on Leucas aspera. Indian Journal of pharmacology, 1947.
[10] Khare, C.P. Indian Medicinal Plants" An illustrated Dictionary, Springer, New Delhi, 2007, p: 444.
[11] Pawluk S. Atomic Absorbtion News Letters, 1967, 6: 53-56.
[12] Jouyban, Z. The Effect of Salt stress on plant growth. Technical Journal of Engineering and Applied Sciences, 2012.
[13] Imelouane, B, Tahri, M, Elbastrioui, M, Aouinti, F. and Elbachiri, A. Mineral contents of Some Medicinal and Aromatic Plants Growing in Eastern Morocco, Journal Materials and .Environmental Science, 2011, 2(2): 104-111.
[14] Hamurcu, M., Musa Ozcan, M., Dursun, N and Gezgin, S. Mineral and heavy metal levels of some fruits grown at the roadside. Food and Chemical Toxicology, 2010, 48: 1767-1770.
[15] Samudralwar, D.L and Garg, A.N. Biological trace element Research, 1996, 54: 113-121.
[16]Masson, P., Dalix, T. and Bussiere, S. Determination of major and trace elements in plant samples by inductively coupled plama-mass spectrometry, Communication in Soil Science ant Plant Analysis, 2010, 41: 231-243.
[17] Savita, G.A., Neetu, S. and Anil Kumar, J. Studies on variation in elemental composition in wild and cultivated forms of Andrographis paniculata, Internationl Journal of Chemical and Pharmaceutical Sciences, 2014 5(2): 75-78.
[18] Sharma, S., Sharma, K.P. and Uppal, S.K. Influence of salt stress on growth and quality on sugarcane, Indian Journal of Plant Physiology, 1997, 2(2): 19-180.