Research Article

Heavy Metals and Mineral Elements contents of Leaves and Stems for some Herbal Plants at AL-Gabal AL-Akhder Region

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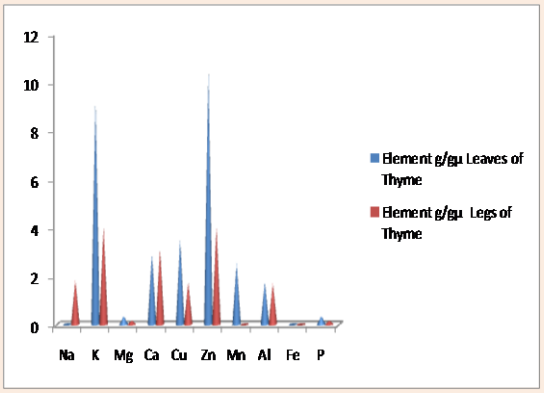
Abstract

Heavy metals and minerals elements contents were determined in leaves and stems of some herbal plants collected from AL-Gabal AL-Akhder region (Libya) during spring(2013).The plants including) Thyme ,Rosemary ,Salvia , Marjoram and Hybrid tea rose.(The heavy metals including (Manganese, Iron, Zinc, Copper and Aluminum) and The Minerals including) Sodium, Potassium ,Calcium, Phosphour and Magnessium .(The results showed difference between the minerals and heavy metals contents in the studied plants, where the high concentration of Zinc10.40 ppm) was found in leaves of Thyme ,while the low concentration of iron was found in Stems. On the other hand the high level of Zinc was found in Rosemary leaves, and the low concentration of iron was in stems. Sodium found lower contents in leaves of salvia 0.06)ppm) with no concentration found in Salvia Stems. The Potassium concentrations found high values in Marjoram leaves, while the phosphour found lower contents in stems of Marjoram 0.01) ppm (with no contents of phosphour were found in Hybrid tea rose in leaves and stems).



Keywords: Herbal Plants, Heavy Metals, Mineral elements, herbal plants, *Marjoram* leaves, high Zinc concentration

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Introduction

Scientific studies of the Libyan flora began about 200 years ago when the Swedish scientist Joran Rothman (1773-1776) collected many plant samples from western Libya and stored them at the Riks Museum in Sweden. Since then, countless collectors and travelers have visited Libya, and there has been considerable interest in the plants of the region. A number of world scientists have undertaken botanical expeditions in the country. Della Cella (1817) collected plants from the eastern part of the country (Bomba gulf), Viviani (1824) wrote the book Flora Libycee Speciments and included 1,200 plant samples, and Barratte & Durrand (1910) wrote a book on Flora Libycee Prodromus with 1,156 plant samples.

During the Italian occupation, Pampanini published Plantae Tripolitania in 1914 and Predromo Della Flora Cirenaica in 1931. In 1942, Corti visited the southern parts of the country, Fezan and Ghat, and wrote a book about his visit. In 1965, Keith published two volumes of A Preliminary Checklist of Libyan Flora and during the period from 1976 to 1988, a group of Libyan scientist published Flora of Libya comprising145 volumes, one for each family.

The Libyan Medicinal and Aromatic Plant Research Program were set up in January 2001 (2001-2005) at the Faculty of Pharmacy, University of Tripoli **(Auzi, 1999).** The program focuses on the chemical and biological evaluation of Libyan medicinal and aromatic plants.

Agronomical studies are aimed at providing information on the growth of medicinal and aromatic plants and the properties of their oils and active constituents **(El-Gadi and Bshana, 1992).** These studies and investigations include the effect of radiation on the quality of medicinal plants, soil analysis and cultivation techniques. The second program for the establishment of a Libyan National Herbarium has been proposed by the Ministry of Environmental General Authority (EGA), Tripoli. The objectives of the program are to provide a better understanding and wider knowledge of the systematic, evolution, ecology and conservation biology of major groups of Libyan native plants and their relatives. The third program, led by the Ministry of Environmental General Authority, started in January 2001 and concentrates on the creation of a database on Libyan Flora in order to make available and disseminate valuable knowledge to a wide client base. **(Auzi, 1999).**

The faculties of science of some Libyan universities are involved in botanical explorations and identification of plants of economic importance. The Biotechnology Research Centre and the Agricultural Research Centre, under the Ministry of Environment and the Ministry of Agriculture respectively, are engaged in the conservation of genetic resources of plant species of medicinal value. **(Walter, 2001).** The main aim of this study is determine the heavy metals and minerals in some herbal plants at Al –Gabal Al –Akhder region (Libya)

Materials and Methods

Sampling:

Five different herbal plants samples were collected from Al-Gabel Al–Kadar Region during Winter-Spring 2012/2013 Seasons, The Samples including (Thyme, Rosemary, sage (salvia), Marjoram and Hybrid tea rose).

The Heavy Metals and Minerals analysis:

The mineral content of the samples, i.e. Na, K, Mg, Ca, Cu, Zn, Mn, Al, Fe and P, were determined. All minerals, except Na, K and P, were determined with an Atomic absorption Spectro-photometer (Milton Roy Perkin Elmer 3300) according to the method described by **Lorenz, *et al.*, (1980)**.

Soluble sodium and potassium contents were carried out with a Flame Photometer (EEL Flame Photometer) according to the method described by **Jackson (1958)**.

Total phosphorus was determined spectrophoto-metrically using the procedure of **Watanabe and Olsen (1965).** After digestion with H_2SO_4 and $HClO_4$ acid **(Sommer and Nelson, 1972)** and were determined using Spectrophotometer according to the method described by **Lorenz, *et al.*, (1980).**

Results and Discussion

The mineral element constituents of the studied herbal plants are shown in **tables (1-5) and figs (1-5).** The concentration of macro elements Zinc was the highest in Leaves of *Thyme, Rosemary, Salvia* and *Hybrid tea rose* followed by Potassium, Copper and Manganese. Leaves of *Thyme, Salvia, Rosemary, Hybrid tea rose* and *Marjoram* contained the highest amount of zinc (10.40, 8.91, 6.30, 5.09 and 4.11 ppm) in comparison with Stems of these herbal plants (4.01, 1.33, 2.91, 1.80 and 0.52 ppm), respectively.The higher concentration of the potassium was present in Leaves of *Thyme* (9.21) followed by Leaves of *Salvia, Rosemary, Marjoram* and *Hybrid tea rose* (7.00, 6.20, 5.03 and 3.01 ppm), respectively and the potassium in Stems of *Thyme, Salvia, Rosemary, Marjoram* and *Hybrid tea rose* (4.01, 3.11, 2.89, 1.94 and 1.83 ppm), respectively. The copper was present in higher concentration in Leaves of *Thyme* (3.50) followed by Leaves of *Rosemary, Marjoram, Hybrid tea rose* and *Salvia* (2.75, 2.09, 1.99 and 1.14 ppm), respectively, and in Stems of *Thyme, Rosemary, Hybrid tea rose, Salvia* and *Marjoram* (1.73, 1.42, 1.01, 0.96 and 0.37 ppm), respectively.

The Manganese was presented in higher concentration in Leaves of *Hybrid tea rose* (3.76), the Lower concentration was in Stems of *Thyme* and *Hybrid tea rose* (0.03) and there wasn't Manganese in Stems of *Salvia*. The Aluminum was present in higher concentration in Leaves of *Hybrid tea rose* and *Thyme* (2 and 1.743 ppm), respectively.

Among the micro element, it seems that sodium in Stems of *Thyme*, *Hybrid tea rose* and *Salvia* was found in higher concentration (1.823, 1.75 and 1.71), respectively ,compared to sodium content in Stems of *Rosemary* and *Marjoram* (1.00 and 0.42) while that calcium in Stems of *Rosemary*, *Salvia* and *Thyme* was found in high concentration (5.33, 3.88 and 3.11 ppm), compared to the other plants. The iron concentrations in Leaves of herbal plants were (0.152, 0.09, 0.08, 0.041 and 0.007 ppm) in *Salvia*, *Rosemary*, *Marjoram*, *Hybrid tea rose* and *Thyme*, respectively, the different between ferric content in Leaves and Stems of studied herbal plants were no biggest. The phosphorus and Magnesium concentrations in Leaves of herbal plants were higher than their concentration in Stems of these herbal plants. The presence of heavy metals in the plants may be coming from different sources as example the iron, Zinc, manganese and copper are presence as oxides or hydroxides and carbonate or bicarbonate compounds in earth crust, or some time coming from air **(Imelouan, *et al*., 2012).**

The present data are in harmony with those found in **(Abdullah, 2013)** study, for Zinc (9.22- 12.43 ppm), copper (1.41-4.43 ppm) in *Thyme* and *Salvia* plants. Most of plants containing minerals (Na, K and P) but are different contents. In this study the contents of sodium are higher than those reported in **(Abdullah, 2013)** study, which it was (0.48 ppm) but they are lower than found in **(Akrout, 2012)** study (7.95 ppm). The sodium and potassium are very important to balance of osmotic pressure of human body and they are have many function .On the other side the phosphors are important for building the ATP &ADP molecules of energy and $PO4^{-3}$ ions which they are activate most of compounds during the biochemical reactions are Glycolysis cycle.

Table 1 Heavy metals and Mineral contents of Leaves and Stems of *Thyme* (ppm)

Element µg/g	Leaves of *Thyme*	Stems of *Thyme*
Na	0.03	1.823
K	9.21	4.01
Mg	0.35	0.16
Ca	2.92	3.11
Cu	3.50	1.73
Zn	10.40	4.01
Mn	2.50	0.03
Al	1.743	1.700
Fe	0.007	0.001
P	0.35	0.16

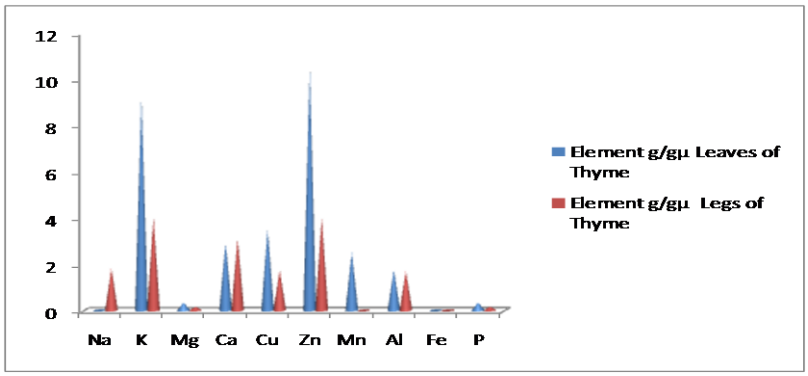

Figure 1 Heavy metals and Mineral element contents of Leaves and Stems of *Thyme*

Table 2 Heavy metals and Mineral contents of Leaves and Stems of *Rosemary* (ppm)

Element µg/g	Leaves of *Rosemary*	Stems of *Rosemary*
Na	2.91	1.00
K	6.20	2.89
Mg	0.84	0.43
Ca	1.99	5.33
Cu	2.75	1.42
Zn	6.30	2.91
Mn	2.01	0.06
Al	1.301	1.31
Fe	0.041	0.02
P	0.61	0.11

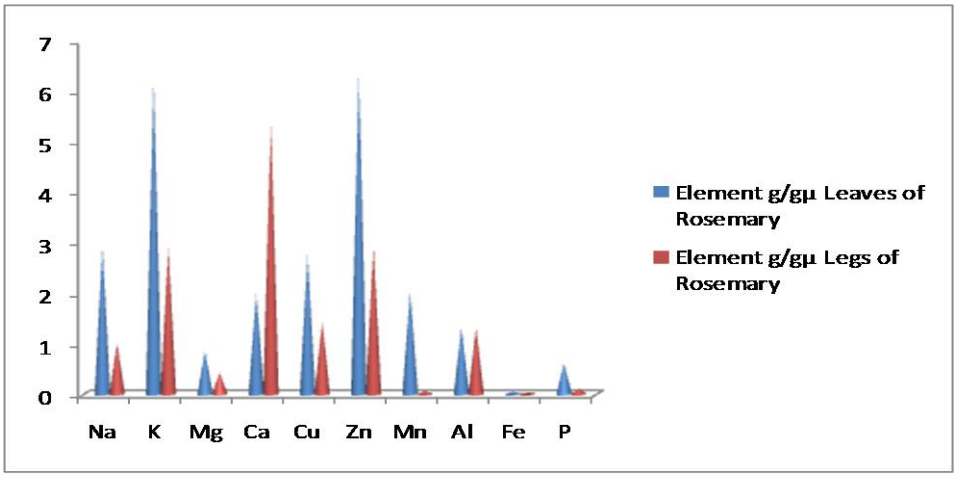

Figure 2 Heavy metals and Mineral element contents of Leaves and Stems of *Rosemary*

Table 3 Heavy metals and Mineral contents of Leaves and Stems of *Salvia* (ppm)

Element µg/g	Leaves of *Salvia*	Stems of *Salvia*
Na	0.06	1.71
K	7.00	3.11
Mg	1.02	0.02
Ca	2.51	3.88
Cu	1.14	0.96
Zn	8.91	1.33
Mn	2.54	0.00
Al	0.921	0.48
Fe	0.152	0.017
P	0.27	0.09

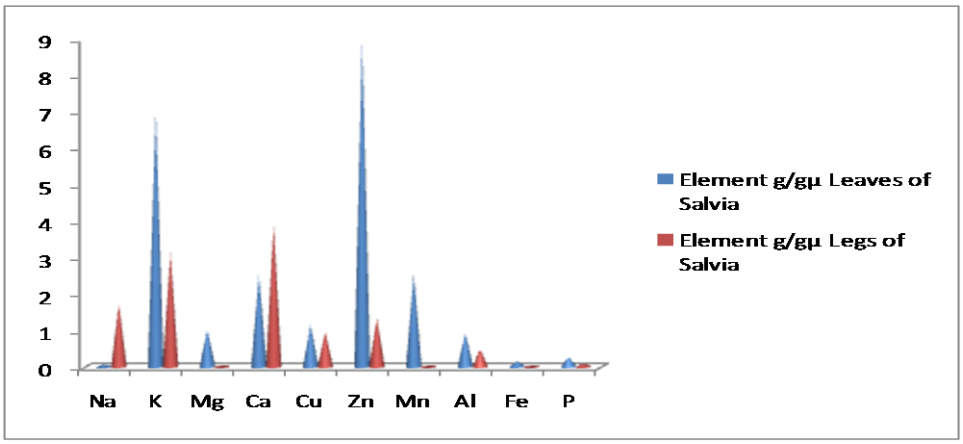

Figure 3 Heavy metals and Mineral element contents of Leaves and Stems of *Salvia*

Table 4 Heavy metals and Mineral contents of Leaves and Stems of *Marjoram* (ppm)

Element µg/g	Leaves of *Marjoram*	Stems of *Marjoram*
Na	2.07	0.42
K	5.03	1.94
Mg	0.68	0.05
Ca	1.10	0.00
Cu	2.09	0.37
Zn	4.11	0.52
Mn	2.43	0.07
Al	0.593	0.12
Fe	0.09	0.03
P	0.00	0.01

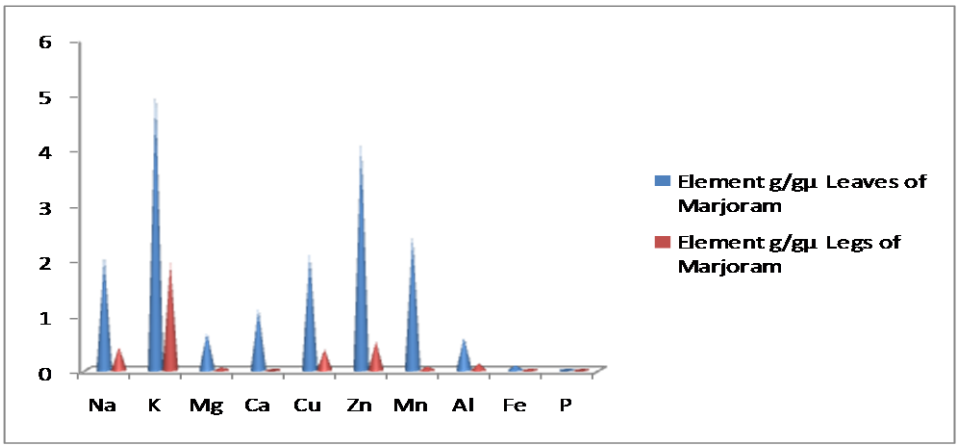

Figure 4 Heavy metals and Mineral element contents of Leaves and Stems of *Marjoram*

Table 5 Heavy metals and Mineral contents of Leaves and Stems of *Hybrid tea rose* (ppm)

Element µg/g	Leaves of *Hybrid tea rose*	Stems of *Hybrid Tea Rose*
Na	0.29	1.75
K	3.01	1.83
Mg	0.51	0.12
Ca	3.05	0.96
Cu	1.99	1.01
Zn	5.09	1.80
Mn	3.76	0.03
Al	2.00	0.40
Fe	0.08	0.02
P	0.00	0.00

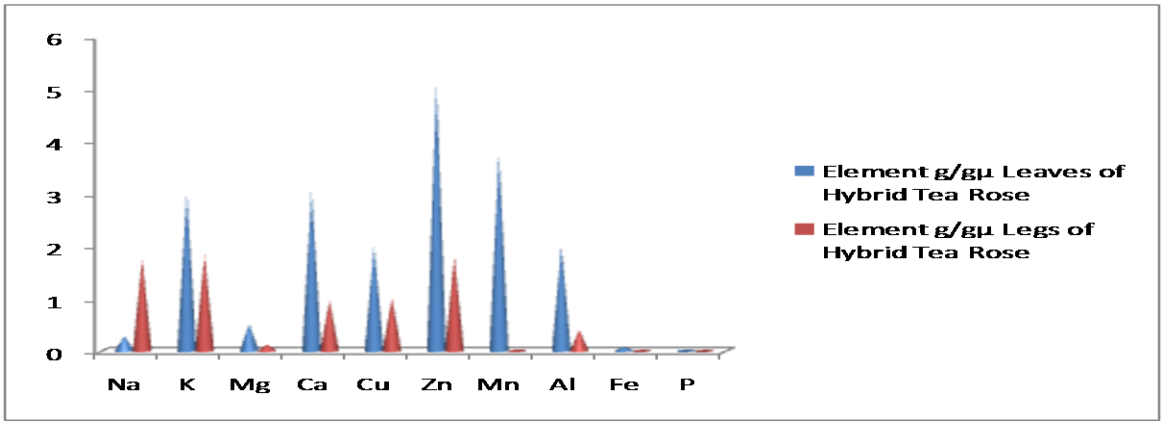

Figure 5 Heavy metals and Mineral element contents of Leaves and Stems of *Hybrid tea rose*.

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