



NOTE

Mineral Compositions of Some Selected *Centaurea* species from Turkey

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Centaurea calolepis Boiss., *Centaurea lydia* Boiss. and *Centaurea polyclada* DC. were investigated for major minerals and trace elements by X-ray fluorescence spectrometry. Calcium and potassium were found in maximum concentrations in *Centaurea* species. The results revealed that the concentrations of iron, manganese and zinc were found to be high in *C. calolepis*. On the other hand, copper, magnesium and phosphorous were found in higher concentrations in *C. polyclada*. Mineral composition of *Centaurea* species, will be descriptive in terms of the traditional use of this species. In addition, *C. calolepis*, *C. lydia* and *C. polyclada* may be utilized in nutraceuticals as potential natural sources of major minerals and trace elements.

Keywords: *Centaurea*, Asteraceae, Minerals, X-ray fluorescence.

Centaurea genus from Asteraceae family is represented with 187 taxa in Turkey¹. *Centaurea* species are used to treat abscesses, hemorrhoids, peptic ulcers, diarrhea and common cold²⁻³. In Turkish folk medicine, the aerial parts of some *Centaurea* species are particularly recommended to reduce fever and for the treatment of abdominal pains⁴.

Previous phytochemical investigations on the genus *Centaurea* revealed the isolations of essential oil, sesquiterpene lactones, flavonoids, lignans and their glycosides⁵⁻⁷. Antioxidant and antimicrobial properties of some *Centaurea* species were previously reported⁸. *Centaurea* species are used in folk medicine for many years in Anatolia⁹. Nevertheless no study reports the content of minerals of any *Centaurea* species.

Medicinal plants are widely used all over the world for human health. The human body also needs a variety of elements for all aspects of body functions. Deficiency of essential minerals leads to a wide range of diseases, on the other hand some elements are harmful in the body even at low concentrations¹⁰.

In the present work, *Centaurea calolepis* Boiss., *Centaurea lydia* Boiss. and *Centaurea polyclada* DC. were investigated for major minerals and trace elements using X-ray fluorescence spectrometry.

C. calolepis, *C. lydia* and *C. polyclada* aerial parts were collected in July 2009 from near Elmali (Antalya), Kemalpaşa (Izmir) and Bayındır (Izmir), respectively. The plants were

identified by Dr. Cenk Durmuskahya from School of Applied Science, Faculty of Education, Celal Bayar University. 1447, 1438 and 1426 herbarium numbers were given to voucher specimens at Faculty of Pharmacy, Pharmacognosy Herbarium, Ege University, Bornova, Izmir, Turkey.

Determination of mineral content: The plant materials were washed with deionized water and dried in an oven at 60 °C. The dried plant materials were cut into small pieces and ground into fine powder. The powdered plant materials were analyzed for trace elements and major minerals by X-ray fluorescence spectrometry. Spectro IQ II (Ametek, Germany) was used for the determination of minerals. Silicon drift detector (SDD) was used to detect elements. The resolution was 145 eV and 10000 pulses. Bragg crystal and highly ordered pyrolytic graphite (HOPG) target polarized the primary beam. 0.1 g of the powdered plant samples were measured during 300 s under the helium atmosphere, at 0.5-1 mA current and at a voltage of 25 kV and 50 kV.

The major minerals (Ca, K, P, S, Na, Cl and Mg) and trace elements (Cu, I, Fe, Mn, Si and Zn) known to be essential to our body were detected in plant materials. The results of mineral composition of *C. calolepis*, *C. lydia* and *C. polyclada* using XRF technique is shown in Table-1.

The concentration of major minerals in *C. calolepis* was found in the order Ca > K > Si > Cl > S > Al. *C. calolepis* contained the highest amount of calcium (2.549 %) and

TABLE-1
MINERAL COMPOSITION OF THE AERIAL PARTS OF
Centaurea calolepis, *C. lydia* and *C. polyclada*^a

Elements	<i>C. calolepis</i>	<i>C. lydia</i>	<i>C. polyclada</i>
Na	0,124	0.141	0.110
Mg	0,1757	0.1445	0.1947
Al	0,2284	0.0445	0.3265
Si	0,9170	0.1009	0.7378
P	0,1755	0.1116	0.197
S	0,2577	0.1220	0.1372
Cl	0,2639	0.2796	0.2082
K	1,284	1.066	1.233
Ca	2,549	1.593	0.6606
Mn	0.02560	0.01712	0.01584
Cu	0.00225	0.00524	0.0060
Fe	0.1317	0.00912	0.03358
Zn	0.00485	0.00331	<0.0001
Br	0.00123	0.00085	0.00061
I	0.00071	<0.00071	<0.0093
Pb	<0.00020	<0.00020	<0.00020

^aExpressed in % on dry weight basis

potassium (1.284 %). The highest amount of sodium was recorded in *C. lydia* (0.141 %). Calcium functions optimally in the body especially in bones and teeth. Along with other essential minerals and vitamins, calcium is involved in blood clotting, blood pressure, nerve function and muscle contraction and relaxation. Sodium and potassium regulate acid-base balance. Sodium is one of the major electrolytes in the blood. Sodium also helps maintain ionic strength of body fluids. Potassium plays a vital role in hormone release, insulin secretion, vascular tone and immune response and facilitates protein synthesis, nerve transmission and normal muscular contractions.

Magnesium and phosphorous were found to be in higher concentrations in *C. polyclada* (0.195-0.197 %). Magnesium is involved in bone mineralization, enzyme action, nerve transmission, protein synthesis and muscular contraction. Phosphorous is involved in part of every cell.

The highest amount of sulfur (0.258 %), silicon (0.917 %) and manganese (0.026 %) was recorded in *C. calolepis*. Sulfur is a part of biotin, thiamin and insulin. Silicon has a structural role in connective tissue. Manganese facilitates cell processes and enzyme functions.

Chloride, a part of stomach acid, is necessary for proper digestion was found to be highest in *C. lydia* (0.280 %). The highest amount of iron (0.132 %) and zinc (0.005 %) was observed in *C. calolepis* whereas the amount of copper (0.006 %) was in maximum concentration in *C. polyclada*. Copper and a part of several enzymes is involved in absorption of iron. Iron is important for haemoglobin formation and energy utilization. Zinc is involved in immunity, vitamin A transport, wound

healing, taste, making sperm and normal fetal development.

In the present study Ca and K were found in major concentrations in *Centaurea species*. Some of the trace elements including Fe, Mn, Zn and Cu are essential micronutrients. The results revealed that the concentrations of Fe, Mn and Zn were found to be high in *C. calolepis*. On the other hand Cu, Mg, Al, P were found in higher concentrations in *C. polyclada*.

Conclusion

X-ray fluorescence spectrometry technique is well suited for multielemental determinations in plant samples. The samples do not need any chemical treatment and any possible contamination is therefore avoided. X-ray fluorescence spectrometry is one of the sensitive, rapid and simple analytical techniques to study the minerals contents of medicinal plants. Trace elements take definite and specific roles in the metabolism of human body. The different concentrations of elements in different plants lead to the conclusion that these plants will have different roles in the treatment of diseases. This preliminary study will be descriptive in terms of the traditional use of *Centaurea species*. In addition, as a rich source of minerals *C. calolepis*, *C. lydia* and *C. polyclada* may be utilized in nutraceuticals as potential natural sources of major minerals and trace elements.

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