KIMYO

UDK: 543.42, 543.45 DOI: 10.56292/SJFSU/vol29_iss1/a126

Prúnus armeníaca L.O‘SIMLIGINING MINERAL TARKIBINI INDUKTIV BOSLANGAN PLAZMALI MASSA SPEKTROMETRIYA USULI BILAN TADQIQ QILISH.

ИССЛЕДОВАНИЕ МИНЕРАЛЬНОГО СОСТАВА РАСТЕНИЯ *Prúnus armeníaca L.* МЕТОДОМ МАСС-СПЕКТРОМЕТРИЕЙ С ИНДУКТИВНО-СВЯЗАННОЙ ПЛАЗМОЙ.

INVESTIGATION OF THE MINERAL COMPOSITION OF THE PLANT *Prúnus armeníaca* L. INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY.

Mirzabdullaeva Dilbar Qudratjon qizi[1], Nazarov Otabek Mamadaliyevich[2]

[1]Mirzabdullaeva Dilbar Qudratjon qizi – Farg‘ona davlat universiteti magistranti
[2]Nazarov Otabek Mamadaliyevich – Farg‘ona davlat universiteti dotsenti, k.f.f.d.(PhD)

Annotatsiya

Farg‘ona viloyatida o‘sadigan Prunus armeníaca L. o‘simligi “Subxoniy” navining mineral tarkibini o‘rganishda induktiv bog‘langan plazma bilan mass-spektrometriya usuli qo‘llanildi. O‘tkazilgan tahlillar natijasida o‘simlikning uchta organida 26 ta makro va mikroelementlarning sifat va miqdoriy tarkibi aniqlandi. Barglardagi makroelementlarning umumiy miqdori 33825,17 mg/l, gulida 26311,769 mg/l, mevalarda 7570,635 mg/l. Makroelementlarning eng yuqori miqdori barglarida kaliyda 22243,325 mg/l hamda eng past makroelement miqdori meva qismida natriy uchun 27,972 mg/l ni tashkil qildi. O‘rik barglaridagi kaliy miqdori minerallarning umumiy massasiga nisbatan foizda 65,76%, gullarida 67,7% va mevalarida 91,7% ni tashkil qiladi. O‘simlikni turli organlarida quyidagi mikroelementlar aniqlandi: Si, Al, Fe, B, Mn, Co, Ni, Cr, Li, Be va V. Zaharli elementlardan faqat qo‘rg‘oshin barglari va gullarida 0,001 mg/l miqdorda aniqlandi. O‘rik mevalari zaharli elementlarni o‘z ichiga olmaydi.

Аннотация

Методом масс-спектрометрии с индуктивно-связанной плазмой исследован минеральный состав растения Prúnus armeníaca L.сорта «Субхоний» произрастающей в Ферганской области. В результате анализов определено качественное и количественное содержание 26 макро- и микроэлементов в трёх органах растения. Общее количество макроэлементов в листьях составляет 33825,17 мг/л; в цветках 26311,769 мг/л и в плодах 7570,635 мг/л. Самое большое содержание из макроэлементов обнаружено для калия в листьях 22243.325 мг/л и самое низкое содержание из макроэлементов обнаружено для натрия в плодах 27.972 мг/л. Содержание калия в листьях абрикоса к общей массе минералов в процентном соотношение составляет 65,76%, в цветках 67,7% и в плодах 91,7%. В различных органах растения обнаружены следующие микроэлементы: Si, Al, Fe, B, Mn, Co, Ni , Cr, Li, Be и V. Из токсичных элементов в листьях и цветках обнаружено 0.001 мг/л свинца. Плоды абрикоса не содержат токсичных элементов.

Abstract

The method of mass spectrometry with inductively coupled plasma was used to study the mineral composition of the plant Prúnus armeníaca L. of the variety "Subkhoniy" growing in the Fergana region. As a result of the analyzes, the qualitative and quantitative content of 26 macro- and microelements in three organs of the plant was determined. The total amount of macronutrients in the leaves is 33825.17 mg/l; in flowers 26311.769 mg/l and in fruits 7570.635 mg/l. The highest content of macronutrients was found for potassium in leaves 22243.325 mg/l and the lowest macronutrient content was found for fruit sodium at 27.972 mg/l. The content of potassium in apricot leaves to the total mass of minerals as a percentage is 65.76%, in flowers 67.7% and in fruits 91.7%. The following trace elements were found in various organs of the plant: Si, Al, Fe, B, Mn, Co, Ni, Cr, Li, Be, and V. Of the toxic elements in the leaves and flowers, 0.001 mg/l of lead was found. Apricot fruits do not contain toxic elements.

Kalit so‘zlar: *makro va mikroelementlar, induktiv-bog’langan palzmali mass-spektrometriya, , Prúnus armeníaca L., kaliy,fosfor,natriy,temir, zaharli element.*

Ключевые слова: *макро- и микроэлементы, масс-спектрометрия с индуктивно-связанной плазмой, Prúnus armeníaca L., калий, фосфор, натрий, железо, токсичный элемент.*

Key words: *macro- and microelements, inductively coupled plasma mass spectrometry, Prúnus armeníaca L., potassium, phosphorus, sodium, iron, toxic element..*

INTRODUCTION

The basis of modern "home" therapeutic practice with the use of apricot fruits was laid by the ancient medical recipes of the peoples of Central Asia. The inhabitants of this region got to know the apricot earlier than anywhere else on the planet, and, accordingly, they also learned about the healing properties of the fruit before others.

LITERATURE REVIEW

Prúnus armeníaca L. is the most commonly cultivated type of apricot. According to the scientific classification, Prúnus armeníaca L. ordinary belongs to the section Apricot(Prunus sect. armeniaca) of the Prunus genus of the Rosaceae family [1]. Six varieties of Prúnus armeníaca L. are currently described: Prunus armeniaca var. ansu, Prunus armeniaca var. armeniaca, Prunus armeniaca var. holosericea, Prunus armeniaca var. meixianensis, Prunus armeniaca var. xiongyueensis and Prunus armeniaca var. zhidanensis[2]. Genetic studies have shown that Central Asia is the center of origin of the apricot[3]. Prúnus armeníaca L.is widely cultivated in many countries of the world.

Prunus armeniaca L. is a small tree 8–12 m high, with a trunk diameter up to 40 cm. The leaves are ovate, 5–9 cm long and 4–8 cm wide, with a rounded base, a pointed tip and a finely serrated edge. The flowers are 2–4.5 cm in diameter, with five white to pinkish petals; they form singly or in pairs in early spring before the leaves appear[2]. The fruits are juicy drupes 1.5–2.5 cm in diameter, yellow to orange, often with a red tinge on the side most exposed to the sun; rounded, elliptical or obovate in outline, with a longitudinal groove. The stone is thick-walled, smooth or rough[4]. The flesh is juicy and its taste can vary from sweet to tart. The single seed is encased in a hard, stony shell, with a granular, smooth texture, except for three ridges running along one side[2]. Fruit weight in cultivated forms 5-80 g. Weight of 1000 "seeds" (pits) 1800 - 2100 g [5]. Fruits in June-August.

Apricot contains various components including water, protein, fat, carbohydrates and dietary fiber. Fresh apricot fruits contain 86.35% water. Minerals are important trace elements in apricot. Each 100 g of apricots contains up to 13 mg of calcium, 0.39 mg of iron, 10 mg of magnesium, 23 mg of phosphorus, 259 mg of potassium, 1 mg of sodium, 0.20 mg of zinc, 0.078 mg of copper, 0.077 mg of manganese and 0.1 mcg of selenium[6].

In total, apricot contains 18 amino acids, including tryptophan, threonine, isoleucine, leucine, lysine, methionine, cystine, phenylalanine, tyrosine, valine, arginine, histidine, alanine, aspartic acid, glutamic acid, glycine, proline, and serine. Lysine and proline are the most predominant amino acids found in fresh apricots and products, and their content in fresh apricots is higher than in apricot products[6].

Polyphenols are generally considered to be one of the most important antioxidant compounds in apricot, and consumption of these compounds has been linked to a reduction in many chronic diseases such as cardiovascular disease, diabetes, and cancer. Natural apricot polyphenols are of great interest to humans. In fresh apricot, procinidins, anthocyanins, flavonols, and derivatives of hydroxycinnamic acids have been identified as the main classes of phenols[7].

Fifteen polyphenols including gallic acid, neochlorogenic acid, procyanidin B1, procyanidin, chlorogenic acid, caffeic acid, (+)-catechin, procyanidin B2, p-coumaric acid, (+)-epicatechin, ferulic acid, quercetin-3-galactoside, quercetin-3-glucoside, quercetin-3-rutinoside, and kaempferol-3-rutinoside have been found in different apricot cultivars at different stages of maturity and geographic region[8].

Flavonols in apricots are found mainly in the form of glucosides and rutinosides of quercetin and kaempferol, however, quercetin-3-rutinoside(rutin) predominates. Esculetin and scopoletin have also been found in smaller amounts in some apricot cultivars[6].

The aim of the research is to qualitatively and quantitatively study the mineral composition of the plant Prúnus armeníaca L. growing in the Fergana region of the Republic of Uzbekistan by the method of inductively coupled plasma mass spectrometry.

MATERIALS AND RESEARCH METHODS

Flowers, leaves and fruits of Prunus armeniaca L. variety «Subkhoniy» were collected in the vicinity of the village of Lagan, Fergana district, Fergana region. Plant samples were dried in a dry room at room temperature in the shade. For research, plant samples were crushed in a mill. Plant samples weighing 0.1 g (100 mg) were weighed on an analytical balance. Plant samples were added with 6 ml of nitric acid and 2 ml of hydrogen peroxide, autoclaved(DAK 100) and placed on a Berghof microwave oven (SpeedWaveXpert).Mineralization of plant samples was carried out for 45 min under conditions of minimum t(323 K), maximum t(503 K), P[bar] max 40[bar]. The autoclave was then cooled and the contents transferred to a 100 ml volumetric flask.

The volume of the solution was brought up to the mark with bidistilled water. The resulting solution was mixed well and placed in a 10 ml test tube. Qualitative and quantitative elemental analysis of plant samples was determined on a mass spectrometer with inductively coupled plasma Perkin Elmer ISP-MS (NexION 2000) using a mineralized solution [9,10].

THE DISCUSSION OF THE RESULTS

In the course of studying the mineral composition of various parts of Prunus armeniaca L. variety «Subkhoniy», the content of 26 elements was analyzed by inductively coupled plasma mass spectrometry. Of these, the content of 17 elements was determined(Table). Among the macronutrients found potassium, calcium, magnesium, sodium, phosphorus and sulfur. The total amount of macronutrients in the leaves is 33825.17 mg/l; in flowers 26311.769 mg/l and in fruits 7570.635 mg/l. This shows that the total macronutrient content decreases from the leaves to the fruit of the apricot. In leaves, the content of macroelements increases in the following order: K > P > Mg > Ca > Na > S; in apricot flowers K > P > Mg > Ca > S > Na and apricot fruits K > Mg > S > P > Ca > Na. The highest content of macronutrients was found for potassium in leaves 22243.325 mg/l. The lowest macronutrient content was found for fruit sodium at 27.972 mg/l. The content of potassium in apricot leaves to the total mass of minerals as a percentage is 65.76%, in flowers 67.7% and in fruits 91.7%. This shows that the fruits are rich in potassium.

Table. The content of macro and microelements in various organs of *Prunus armeniaca* L.variety "Subkhon", mg/l.

№	Element	Apricot leaves	Flowers apricot	Fruit apricot
1	Li 7 (mg/l)	0.083	0.165	0.010
2	Be 9 (mg/l)	0.003	0.003	0.001
3	B 11 (mg/l)	7.078	6.629	5.344
4	Na 23(mg/l)	793.906	136.762	27.972
5	Mg 24(mg/l)	3652.617	2771.256	301.267
6	Al 27(mg/l)	263.479	229.515	134.515
7	Si 28(mg/l)	306.106	373.901	9.019
8	P 31(mg/l)	5198.958	4349.774	81.427
9	S 32(mg/l)	740.833	475.102	154.690
10	K 39(mg/l)	22243.325	17813.653	6942.300
11	Ca 42(mg/l)	1195.531	765.222	62.979
12	Ti 48(mg/l)	0	0	0
13	V 51(mg/l)	0.008	0.027	0
14	Cr 52(mg/l)	0.121	0.080	0.024
15	Mn 55(mg/l)	1.217	1.306	0.088
16	Fe 57(mg/l)	75.456	69.166	5.316
17	Co 59(mg/l)	0.010	0.010	0.001
18	Ni 60 (mg/l)	0.092	0.080	0.018
19	Ta 181(mg/l)	0	0	0
20	W 184(mg/l)	0	0	0
21	Re 187(mg/l)	0	0	0
22	Hg 202(mg/l)	0	0	0
23	Tl 205(mg/l)	0	0	0
24	Pb 208(mg/l)	0.001	0.001	0
25	Bi 209(mg/l)	0	0	0
26	U 238(mg/l)	0	0	0

The following trace elements were found in various parts of *Prunus armeniaca* L. variety «Subkhoniy»: *Si, Al, Fe, B, Mn, Co, Ni, Cr, Li, Be* and *V*. Although 11 trace elements were found, significant contents were found for silicon, aluminum, iron, boron and manganese. The highest content of microelements was found for silicon in leaves 306.106 mg/l. The lowest content of trace elements was found for aluminum in fruits 134.515 mg/l.

Like macronutrients, the content of microelements decreases sharply when moving from leaves and flowers to apricot fruits. But when considering the content of aluminum in the three organs of the plant, the concentration of aluminum does not change so dramatically. Leaves contain 263.479 mg/l, flowers 229.515 mg/l and fruits 134.515 mg/l. Of the toxic elements, only lead was found. The leaves and flowers contained 0.001 mg/l of lead. Apricot fruits do not contain toxic elements. Fresh and dried apricot fruits can be used in various plant-based biologically active supplements: dry, liquid, tableted, encapsulated, powdered, mixtures of dried medicinal plants(teas).

CONCLUSIONS

A qualitative and quantitative analysis was carried out by mass spectrometry with inductively coupled plasma of macro- and microelements of various organs of *Prunus armeniaca* L. variety «Subkhoniy» growing in the Fergana region of the Republic of Uzbekistan. Defined content of 26 minerals. The obtained results, the results show that the plant is a source of macronutrients such as K, P, Mg, Ca, Na and S. In apricot fruits, the potassium content is 91.7% of the total content of elements. The results of the study showed that the highest concentration of macro- and microelements is observed in the leaves of *Prunus armeniaca* L. variety «Subkhoniy». Of the toxic elements, only lead was found in a minimal amount in the leaves and flowers of the plant.

REFERENCES

1.Pollard R.P.; Rhodes L.; Maxted N., Rivers M.C.."*Prunus armeniaca*". *IUCN Red List of Threatened Species*.2000: e.T50134200A50134213.

2.Lu Lingdi; Bartholomew Bruce."*Armeniaca vulgaris*". In Wu, Z.Y.; Raven, P. H.; Hong, D.Y. (eds.).*Flora of China*.2003. Vol.9. Beijing & St. Louis: Science Press & Missouri Botanical Garden Press.pp.396–401.

3.Bourguiba Hedia; Scotti Ivan; Sauvage Christopher; Zhebentyayeva Tetyana; Ledbetter Craig; Krška Boris; Remay Arnaud; D'Onofrio Claudio; Iketani Hiroyuki; Christen Danilo; Krichen Lamia."Genetic structure of a worldwide germplasm collection of *Prunus armeniaca* L. reveals three major diffusion routes for varieties coming from the species' center of origin". *Frontiers in Plant Science*.2020.11:638.

4.Сергиевская Е.В.Систематика высших растений. Практический курс. 2-е изд.СПб.: Лань,2002.С.229—230.

5.Атлас лекарственных растений СССР/ Гл. ред. акад. Н.В.Цицин. М.:Медгиз,1962.С.2.

6.Nutritional Composition and Antioxidant Properties of Fruits and Vegetables. Edited by Amit K. Jaiswal. Academic Press. Elsevier, 2020.pp.613-629.

7.Radi M., Mahrouz M., Jaouad A., Tacchini M., Aubert S., Hugues M., Amiot M.J. Phenolic composition, browning susceptibility, and carotenoid content of several apricot cultivars at maturity. *HortScience*.1997.32(6),pp.1087–1091.

8.Dragovic-Uzelac V., Levaj B., Mrkic V., Bursac D., Boras M. The content of polyphenols and carotenoids in three apricot cultivars depending on stage of maturity and geographical region. *Food Chem*.2007.102(3),pp.966-975.

9.Расулова М.О., Назаров О.М., Амирова Т.Ш. Определение содержания макро-и микроэлементов в различных видах кожи методом масс-спектрометрии с индуктивно-связанной плазмой. *Universum*: *химия и биология*. 2022.6-2(96).С.18-22.

10.Карабаева Р.Б., Ибрагимов А.А., Назаров О.М.Определение содержания химических элементов и аминокислот в *Prunus persica* var. Nectarina. *Universum: химия и биология*.2020. 9 (75).С.15-18.