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FARG‘ONA VODIYSI SHAROITIDA YETISHTIRILGAN QORA MEVALI ARONIYA *(ARONIA MELANOCARPA L.)* MEVASINING KIMYOVIY TARKIBI TAHLILI

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Maqolada O‘zbekistonda introduksiya qilingan qora mevali aroniya (Aronia melanocarpa L.) dorivor o‘simligining kimyoviy tarkibi tahlil qilingan. Mazkur o‘simlik mevasining kimyoviy tarkibini o‘rganishdan asosiy maqsad dorivor o‘simlik xomashyosiga bo‘lgan ehtiyojni qondirish, xomashyo ta’minotini tabiiylashtirish va mahalliylashtirishdan iborat. Shuningdek, mazkur dorivor o‘simlikdan tibbiyotda keng foydalanish imkoniyatlari hamda uning ahamiyati yoritilgan.

Kalit so‘zlar: *dorivor o‘simlik, ozuqabop o‘simlik, biologik faol moddalar, flavonoidlar, polifenollar*.

В статье впервые анализируется химический состав лекарственного растения аронии черноплодной (Aronia melanocarpa L.), интродуцированной в Узбекистан. Изучение химического состава плодов направлено на определение возможности использования данного растения в качестве лекарственного сырья, его натурализацию и локализацию сырьевой базы. Освещается применение аронии черноплодной в медицине, а также её значение как источника биологически активных веществ.

Ключевые слова: *лекарственное растение, пищевое растение, биологически активные вещества, флавоноиды, полифенолы.*

Ma’lumki, tabiiy biologik faol birikmalar kimyoviy moddalarga nisbatan bir qator afzalliklarga ega. Shu jihatdan turli farmakologik faollikka ega bo‘lgan tabiiy biologik faol moddalar kompleksini saqlovchi dorivor o‘simliklarni o‘rganish alohida dolzarblik kasb etadi. Tarkibida turli xil biologik faol moddalar kompleksini saqlovchi boy kimyoviy tarkibga ega o‘simliklardan biri, shubhasiz, qora mevali aroniya (*Aronia melanocarpa L.*) hisoblanadi. Mevasi dorivor xomashyo bo‘lgan bu o‘simlik ayni vaqtda bir qator mamlakatlarda oziq-ovqat sanoatida ham faol ishlatib kelinmoqda. Tibbiy maqsadlarda qora mevali aroniya *(Aronia melanocarpa L.)* dorivorlik xususiyatlariga ega bo‘lgan o‘simlik sifatida foydalanib kelinadi, chunki uning mevasi tarkibida ko‘p miqdorda biologik faol moddalar mavjud [1].

Mazkur biologik moddalar inson tanasiga sintetik dorilarga nisbatan ancha foydali ta’sir qiladi, yaxshi hazm qilinadi, salbiy allergik reaksiyalarni keltirib chiqarmaydi va ular organizmda to‘planib qolmaydi. Ular ko‘plab kasalliklarni davolash xususiyatiga ega, juda ko‘p siyish, qon ketish, ich qotishda, qon tomirlarini kengaytiruvchi sifatida hamda quruq yo‘tal bilan og‘rigan kasallarga yordam beradi [2]. Shu sababli qora mevali aroniya *(Aronia melanocarpa L.)* mevasida biologik faol moddalar guruhlarini aniqlash dolzarb hisoblanadi.

Yuqorida qayd etilgan talab va ehtiyojlarni hisobga olgan holda Farg‘ona vodiysi sharoitida yetishtirilgan introdutsent dorivor o‘simliklardan biri – qora mevali aroniya *(Aronia melanocarpa L.)* mevasining kimyoviy tarkibini tahlil etish maqsad qilib olindi.

Qora mevali aroniya *(Aronia melanocarpa L.)* o‘zining oddiyligi va sovuqqa chidamliligi tufayli Rossiyaning deyarli barcha ekologik-geografik hududlarida introduksiya qilingan, u Yevropa qismining shimoliy hududlarida, G‘arbiy va Sharqiy Sibir, Sharqiy Qozog‘iston va Uralning og‘ir sharoitlarida ham barqaror hosil bergan [1]. U 1,5–3 metrgacha o‘sadigan ko‘p yillik, poyasi kuchli shoxlangan buta o‘simlik hisoblanadi. Ildiz sistemasi popuk ildiz bo‘lib, shoxlangan va 15–20 sm gorizontal va 1 m chuqurlikkacha vertikal ravishda o‘sadi. Barglari oddiy, yaltiroq, tim yashil rangda bo‘lib, kuz oylarida tim sariq va qizil rangga kiradi. Gullari mayda bo‘lib, 10–20 tasi to‘planib to‘pgul hosil qilgan. Mevalari dumaloq shaklda, qora rangda bo‘lib, o‘rtacha 1–1,5 g og‘irlikka ega bo‘ladi. Mazkur o‘simlikni urug‘idan va qalamchalaridan bahor va kuz oylarida

toshli, shag‘alli, sho‘r tuproqlarda ekib ko‘paytirish mumkin.

U mezofit o‘simlik bo‘lib, namlik yetarli bo‘lganda ko‘proq hosil beradi. Tuproqda namlik miqdori kam vaqtda mevalari mayda bo‘lib, hosildorlik pasayishi mumkin (1-rasm).



1-rasm: Qora mevali aroniya *(Aronia melanocarpa L.)* **o‘simligining umumiy ko‘rinishi**.



2-rasm: Farg‘ona vodiysi sharoitida introduksiya qilingan qora mevali aroniya (*Aronia melanocarpa L.*) mevasi.

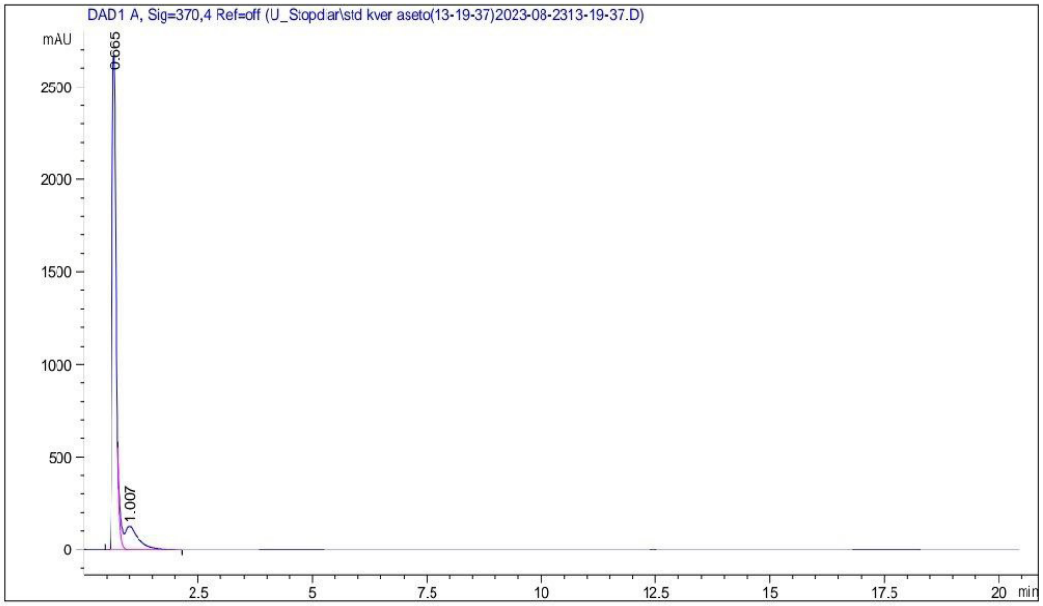
Tadqiqotlarimiz shuni ko‘rsatdiki, qora mevali aroniya *(Aronia melanocarpa L.)* (2022–2024-yillar kesimida) 17–22-mart kunlari g‘unchalashni boshlab, 26-mart–5-aprel kuniga yalpi g‘unchalash kuzatildi. O‘simlikning gullashi 23–29-martda boshlanib, yalpi gullash aprel oyining 1–13-kunlariga to‘g‘ri keldi. 4–9-aprelda meva tugish boshlanib, 23–28-aprel kunlari yakunlandi. Meva rangi yashil tusdan to‘q qizil tusga o‘zgarganida to‘liq pishadi.

O‘simlikning yalpi pishish davri 15–23-avgust kunlariga to‘g‘ri keldi, mevalarning pishish jarayoni esa 7–15-sentabr kunlarida yakunlandi. Hosilni terib olish muddati yilning ob-havo sharoitlariga bog‘liq bo‘ladi.

O‘simlik mevalarining juda muhim xususiyati ularning chidamliligidir. Chunki uning mevalari terib olinmasa ham, u butun qish davomida saqlanib qoladi, qutilarda saqlanganda holati buzilmaydi (2-rasm).

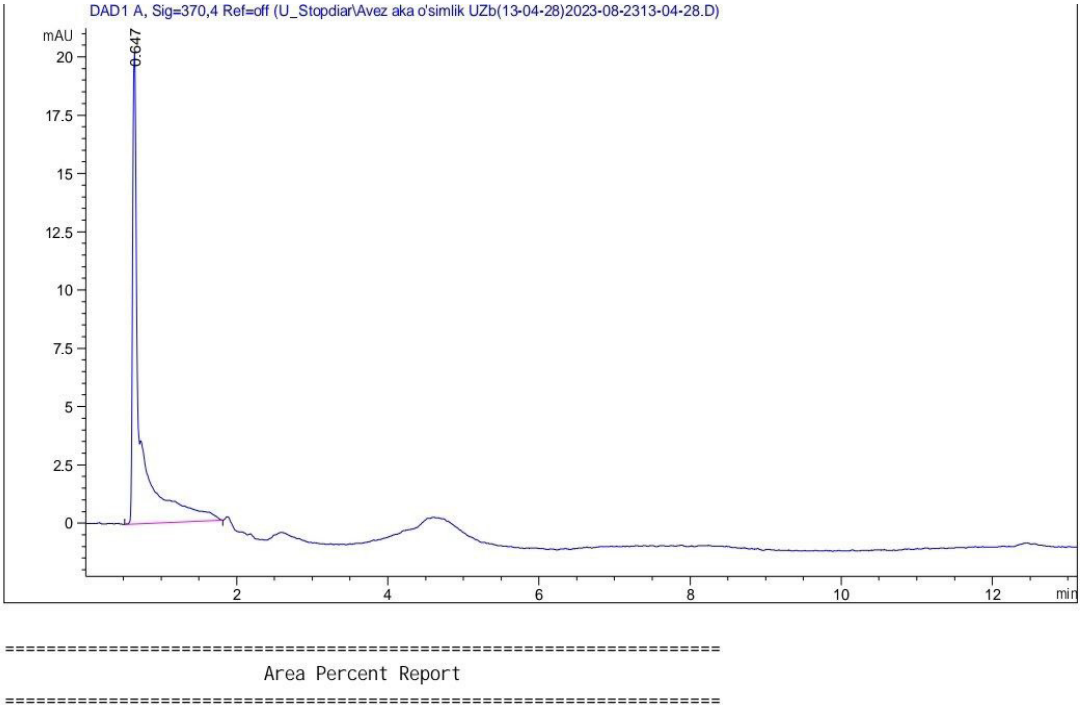
Aynan Farg‘ona vodiysi iqlim va tuproq sharoitidagi o‘simlikning ayrim generativ organlarining fitokimyoviy tarkibiga izoh beramiz. Ushbu tahlillarni o‘rganish Toshkent farmatsevtika instituti olimlari bilan hamkorlikda amalga oshirildi. Qora mevali aroniya *(Aronia melanocarpa L.)* tarkibidagi flavonoidlar miqdorini aniqlash uchun Farg‘ona vodiysida introduksiya qilingan o‘simlik mevasi olindi. Dastlabki bosqichda ekstraksiya olish jarayoni amalga oshirildi. Ekstrakt tarkibidagi flavonoidlar miqdori yuqori samarali suyuqlik xromatografiyasi (YuSSX) usulida aniqlandi.

Uning maydalangan mevalari 1:10 nisbatda 75% li metanol (h/h) eritmasi bilan 25°C ultratovushli hammomda 15 daqiqa mobaynida ekstraksiyalandi (1,147 *g*:11 *ml* ekstragent). Olingan ekstrakt flakonlarga quyilib, muzlatgichda saqlandi. Yuqori samarador suyuqlik xromatografiyasida tahlil uchun eritma tayyorlandi. Ishchi standart namunasi (ISN) kversetin eritmasini tayyorlash uchun 0,010 *g* kversetin 10 *ml* metanol bilan eritildi va hajmi bir xil erituvchi bilan moslashtirildi (3-rasm).



3-rasm. Kversitin ishchi standart namunasining xromatografiyasi.

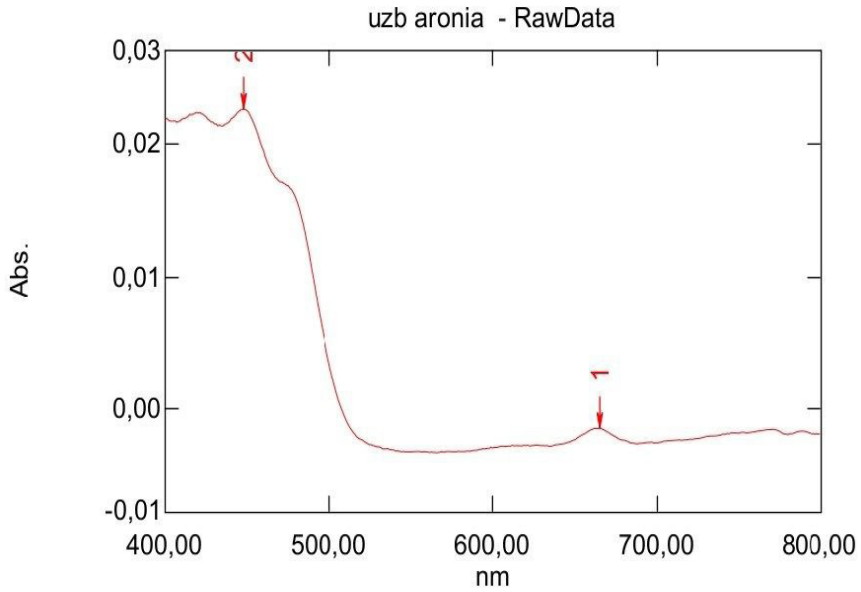
1 *ml* ekstrakt 50 *ml* hajmli o‘lchov kolbasiga solindi, 60 *ml* **metanol qo‘shili**b aralashtirildi va eritma hajmi metanol yordamida kolba belgisigacha yetkazildi. Har bir mahsulotdan 50 *g* namuna tarkibida 4% li sirka kislotasi bo‘lgan 50 *ml* atsetonitrilga qo‘shildi va blenderda 2 daqiqa davomida bir xil massa hosil bo‘lguncha gomogenlashtirildi. Qayta ishlov berilgandan so‘ng, gomogenatdan olingan namunaga blenderni yuvish uchun tarkibida 4% li sirka kislotasi bo‘lgan 25 *ml* atsetonitril qo‘shildi va hosil bo‘lgan eritma dastlabki ekstrakt bilan birlashtirildi (4-rasm).



4-rasm. Qora mevali aroniya *(Aronia melanocarpa L.)* mevalari ekstraktining xromatorammasi.

Birlashtirilgan gomogenat xona haroratida har 3 daqiqada kamida 30 daqiqa davomida chayqalib, keyin so‘ndirildi, 4°C da 15 daqiqa sentrifugalandi. Pelet sentrifugadan so‘ng 50 *ml* atsetonitril bilan yuvildi hamda 4% li sirka kislotasi aralashtirilib, sentrifugalandi. Supernatantlar dastlabki ekstrakt bilan birlashtirildi. Har bir mahsulotdan uch nusxadagi ekstraktlar tayyorlangan.

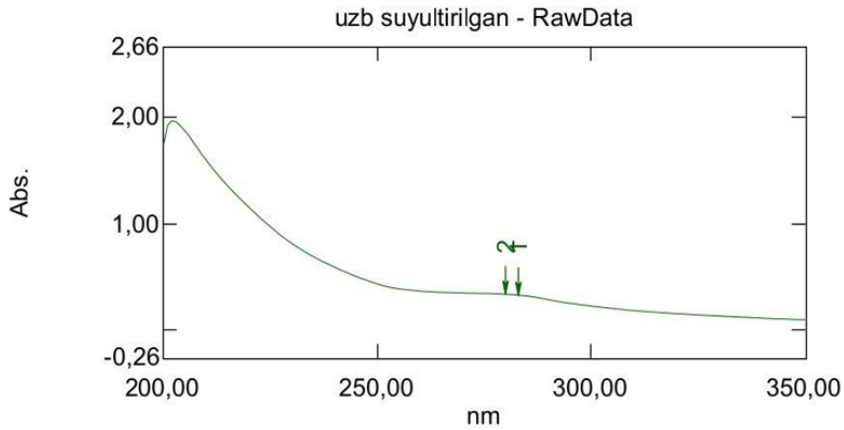
Jami antosiyaninlar pH differensial usuli bilan baholanadi (Cheng va Breen, 1991). Adsorbsiya Bekman spektrofotometrida 510 *nm* va 700 *nm*.da buferlar pH 1,0 va 4.5, A) [(A510 – A700) pH 1.0 – (A 510 – A 700) pH 4.5] yordamida siyanidin-3-glyukozidning molyar so‘nish koeffitsienti 29600 ga teng ekanligi ma’lum bo‘ldi. Natijalar yangi namunaning 100 g massasiga nisbatan siyanidin-3-glukozid ekvivalenti (C3G/100 g yangi massa) sifatida ifodalandi. Tahlil natijalariga ko‘ra, Farg‘ona vodiysi sharoitida yetishtirilgan aroniya mevalari tarkibida umumiy antosianinlar miqdori 0,004% ni tashkil etdi (5-rasm).



5-rasm. Farg‘ona vodiysida introduksiya qilingan qora mevali aroniya (*Aronia melanocarpa L.*) mevalari tarkibidagi antosiyaninlar UB-spektri.

Tayyorlangan kalibrlash eritmalari aralashtiriladi va optik zichlik spektrofotometrda 280 *nm* to‘lqin uzunligida o‘lchandi. O‘lchash gallik kislotasi bo‘lmagan etalon eritmaga nisbatan yutuvchi qatlam qalinligi 10 *mm* bo‘lgan kyuvetlarda amalga oshirildi. Kalibrlash grafigi tuzildi: kalibrlash kislotasi eritmalarining optik zichliklari ordinata o‘qi bo‘yicha chizildi va kalibrlash eritmasidagi gallik kislota miqdorining mos keladigan qiymatlari absissa eritmasi (*mkg*) bo‘yicha chizilgan. Kalibrlash jadvali bir marta tekshirildi.

Yig‘ilgan namunalar filtr probirkaga o‘tkazildi va 5 *ml* 0,01 mol/l xlorid kislota eritmasi bilan ishlandi. Eritma o‘z navbatida silindrga o‘tkazildi va 0,01 mol/l xlorid kislota eritmasi bilan 10 *ml*.ga suyultirildi. Spektrofotometriya uchun 3 *ml* eritma oli*ndi*. Gallik kislota namunasi tahlil qilinadigan eritmasining optik zichligi bir vaqtning o‘zida va namunaga o‘xshash tarzda tayyorlanadigan nazorat bilan solishtirganda kalibrlash eritmalariga o‘xshash tarzda o‘lchandi (6-rasm).



6-rasm. Farg‘ona vodiysida introduksiya qilingan qora mevali aroniya *(Aronia melanocarpa L.)* mevalari tarkibidagi polifenollar UB-spektri.

Tahlil qilinayotgan namunadagi gallik kislota *(mkg)* miqdorini aniqlash oldindan tuzilgan kalibrlash grafigi bo‘yicha amalga oshirildi. Konsentratsiyani hisoblash havodagi gallik kislotaning 1 *mg*/*m*³ (C) dagi konsentratsiyasi: C-d *v / 6. V formula bo‘yicha hisoblandi, bunda tahlil qilinayotgan gallik kislota miqdori, kalibrlash egri chizig‘idan topilgan namuna eritmasining hajmi, *mkg*; namuna eritmasining umumiy hajmi, *ml*; namuna eritmasi hajmi, *ml*; bu – tahlil qilish uchun tanlangan va berilgan havo hajmiga teng bo‘ladi.

Spektrofotometrik tahlil natijalariga ko‘ra, tekshirilayotgan namuna gallik kislotasiz kalibrlash eritmasiga nisbatan 270 nm to‘lqin uzunligida sezilarli nur yutilishini namoyon etdi. Hisoblash natijalariga ko‘ra, qora mevali aroniya (*Aronia melanocarpa* L.) mevalari tarkibidagi polifenolik kislotalarning umumiy miqdori 0,89% ni tashkil etdi.

Farg‘ona vodiysi iqlimi va tuproq sharoitidagi qora mevali aroniya *(Aronia melanocarpa L.)*ning introduksiyasi ijobiy natijalar berdi, ya’ni o‘simlikning mevalari avgust oyining ikkinchi dekadasida pishib yetiladi va ular uzoq vaqt o‘z sifatini saqlash xususiyatiga ega. Farg‘ona vodiysi sharoitida introduksiya qilingan o‘simlikning mevasi tarkibida flavonoidlar miqdori kversetinga nisbatan 0,305%, pH differensial usuli bilan baholanganda 0,004% ni, polifenol kislotalar 0,89% ni tashkil etdi.

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ANALYSIS OF THE CHEMICAL COMPOSITION OF THE FRUIT OF BLACK-FRUITED ARONIA *(ARONIA MELANOCARPA L.)*, GROWN IN THE CONDITIONS OF THE FERGANA VALLEY

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Keywords: medicinal plant, food plant, biologically active substances, flavonoids, polyphenols.

The study of the chemical composition of the medicinal plant black chokeberry (Aronia melanocarpa L.), introduced in Uzbekistan, is currently considered one of the relevant scientific directions. In this article, the chemical composition of the fruit of this plant is analyzed in depth for the first time under local conditions, and its biological and pharmacological significance is widely described. The main objective of the research is to meet the demand for medicinal plant raw materials in our republic, create local resources that can substitute imports, and introduce plants rich in natural biologically active compounds into practical use through their introduction. In this regard, black chokeberry deserves special attention as a promising plant.

It is well known that natural biologically active substances (flavonoids, polyphenols, organic acids, vitamins, and microelements) have several advantages over synthetic chemical compounds. In particular, they have a mild effect on the human body, cause fewer side effects, and possess complex therapeutic properties. Therefore, the in-depth study of medicinal plants is of great scientific and practical importance in the fields of pharmaceuticals and medicine. Black chokeberry (Aronia melanocarpa L.) is distinguished by its rich chemical composition. Its fruits contain flavonoids (mainly quercetin derivatives), anthocyanins, polyphenolic compounds, ascorbic acid (vitamin C), pectin substances, as well as macro- and microelements.

This plant is not only medicinal but is also widely used in the food industry. In particular, it is used for the production of juices, jams, extracts, and biologically active supplements. It has strong antioxidant properties and plays an important role in preventing cardiovascular diseases, strengthening the immune system, and improving metabolic processes. The research was carried out in collaboration with scientists from the Tashkent Pharmaceutical Institute. Fruits of plants introduced under the conditions of the Fergana Valley were selected for the experiments. Initially, extracts were obtained from the plant raw material. At the next stage, the content of flavonoids in the extract was determined using a modern analytical method–high-performance liquid chromatography (HPLC).

The results of the study showed that the introduction of black chokeberry in the soil and climatic conditions of the Fergana Valley was successful. The fruits fully ripen in the second decade of August and retain their quality characteristics for a long time. This indicates that the plant is suitable for large-scale cultivation. The obtained results demonstrate that black chokeberry is not only valuable as a food product but also as a medicinal plant rich in biologically active compounds. In particular, its antioxidant and pharmacological properties allow it to be widely used in modern medicine and pharmaceuticals.

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