E-ISSN 2181-1466
9 772181 146004

ISSN 2181-6875
9 772181 687004

@buxdu_uz @buxdu1 @buxdu1 www.buxdu.uz

Научный вестник Бухарского государственного университета
Scientific reports of Bukhara State University

2/2025

BUXORO DAVLAT UNIVERSITETI

# BUXORO DAVLAT UNIVERSITETI
# ILMIY AXBOROTI




2/2025
https://buxdu.uz

**BUXORO DAVLAT UNIVERSITETI ILMIY AXBOROTI**
**SCIENTIFIC REPORTS OF BUKHARA STATE UNIVERSITY**
**НАУЧНЫЙ ВЕСТНИК БУХАРСКОГО ГОСУДАРСТВЕННОГО УНИВЕРСИТЕТА**

**Ilmiy-nazariy jurnal**
**2025, № 2, fevral**

Jurnal 2003-yildan boshlab **filologiya** fanlari bo‘yicha, 2015-yildan boshlab **fizika-matematika** fanlari bo‘yicha, 2018-yildan boshlab **siyosiy** fanlar bo‘yicha, **tarix** fanlari bo‘yicha 2023-yil 29-avgustdan boshlab O‘zbekiston Respublikasi Oliy ta’lim, fan va innovatsiyalar Vazirligi huzuridagi Oliy attestatsiya komissiyasining dissertatsiya ishlari natijalari yuzasidan ilmiy maqolalar chop etilishi lozim bo‘lgan zaruriy nashrlar ro‘yxatiga kiritilgan.

Jurnal 2000-yilda tashkil etilgan. Jurnal 1 yilda 12 marta chiqadi.

Jurnal O‘zbekiston matbuot va axborot agentligi Buxoro viloyat matbuot va axborot boshqarmasi tomonidan 2020-yil 24-avgust № 1103-sonli guvohnoma bilan ro‘yxatga olingan.

**Muassis: Buxoro davlat universiteti**
**Tahririyat manzili:** 200117, O‘zbekiston Respublikasi,Buxoro shahri Muhammad Iqbol ko‘chasi, 11-uy.
Elektron manzil: nashriyot_buxdu@buxdu.uz

**TAHRIR HAY’ATI:**

**Bosh muharrir:** Xamidov Obidjon Xafizovich, iqtisodiyot fanlari doktori, professor
**Bosh muharrir o‘rinbosari:** Samiyev Kamoliddin A’zamovich, texnika fanlari doktori (DSc), dotsent
**Mas’ul kotib:** Shirinova Mexrigiyo Shokirovna, filologiya fanlari bo‘yicha falsafa doktori (PhD), dotsent

**Kuzmichev Nikolay Dmitriyevich**, fizika-matematika fanlari doktori (DSc), professor (N.P. Ogaryov nomidagi Mordova milliy tadqiqot davlat universiteti, Rossiya)
**Danova M.,** filologiya fanlari doktori, professor (Bolgariya)
**Margianti S.E.,** iqtisodiyot fanlari doktori, professor (Indoneziya)
**Minin V.V.,** kimyo fanlari doktori (Rossiya)
**Tashqarayev R.A.,** texnika fanlari doktori (Qozog'iston)
**Mo‘minov M.E.,** fizika-matematika fanlari nomzodi (Malayziya)
**Mengliyev Baxtiyor Rajabovich,** filologiya fanlari doktori, professor
**Adizov Baxtiyor Rahmonovich,** pedagogika fanlari doktori, professor
**Rasulov To‘lqin Husenovich,** fizika-matematika fanlari doktori (DSc), professor
**Abuzalova Mexriniso Kadirovna**, filologiya fanlari doktori, professor
**Amonov Muxtor Raxmatovich**, texnika fanlari doktori, professor
**Barotov Sharif Ramazonovich**, psixologiya fanlari doktori, professor, xalqaro psixologiya fanlari akademiyasining haqiqiy a’zosi (akademigi)
**Baqoyeva Muhabbat Qayumovna**, filologiya fanlari doktori, professor
**Bo‘riyev Sulaymon Bo‘riyevich**, biologiya fanlari doktori, professor
**Jumayev Rustam G‘aniyevich**, siyosiy fanlar nomzodi, dotsent
**Djurayev Davron Raxmonovich**, fizika-matematika fanlari doktori, professor
**Durdiyev Durdimurod Qalandarovich**, fizika-matematika fanlari doktori, professor
**Olimov Shirinboy Sharofovich**, pedagogika fanlari doktori, professor
**Qahhorov Siddiq Qahhorovich**, pedagogika fanlari doktori, professor
**Umarov Baqo Bafoyevich**, kimyo fanlari doktori, professor
**Murodov G‘ayrat Nekovich**, filologiya fanlari doktori, professor
**O‘rayeva Darmonoy Saidjonovna**, filologiya fanlari doktori, professor
**Navro‘z-zoda Baxtiyor Nigmatovich,** iqtisodiyot fanlari doktori, professor
**Hayitov Shodmon Ahmadovich**, tarix fanlari doktori, professor
**To‘rayev Halim Hojiyevich**, tarix fanlari doktori, professor
**Rasulov Baxtiyor Mamajonovich**, tarix fanlari doktori, professor
**Eshtayev Alisher Abdug‘aniyevich,** iqtisodiyot fanlari doktori, professor
**Quvvatova Dilrabo Habibovna**, filologiya fanlari doktori, professor
**Axmedova Shoira Nematovna**, filologiya fanlari doktori, professor
**Bekova Nazora Jo’rayevna**, filologiya fanlari doktori (DSc), professor
**Amonova Zilola Qodirovna**, filologiya fanlari doktori (DSc), dotsent
**Hamroyeva Shahlo Mirjonovna,** filologiya fanlari doktori (DSc), dotsent
**Nigmatova Lola Xamidovna,** filologiya fanlari doktori (DSc), dotsent
**Boboyev Feruz Sayfullayevich**, tarix fanlari doktori
**Jo‘rayev Narzulla Qosimovich**, siyosiy fanlar doktori, professor
**Xolliyev Askar Ergashovich**, biologiya fanlari doktori, professor
**Artikova Hafiza To‘ymurodovna**, biologiya fanlari doktori, professor
**Norboyeva Umida Toshtemirovna**, biologiya fanlari doktori, professor
**Hayitov Shavkat Ahmadovich**, filologiya fanlari doktori, professor
**Qurbonova Gulnoz Negmatovna**, pedagogika fanlari doktori (DSc), professor
**Ixtiyarova Gulnora Akmalovna**, kimyo fanlari doktori, professor
**Rasulov Zubaydullo Izomovich,** filologiya fanlari doktori (DSc), dotsent
**Mirzayev Shavkat Mustaqimovich**, texnika fanlari doktori, professor
**Esanov Husniddin Qurbonovich**, biologiya fanlari doktori, dotsent
**Raupov Soyib Saidovich**, tarix fanlari nomzodi, professor
**Zaripov Gulmurot Toxirovich**, texnika fanlari nomzodi, professor
**Jumayev Jura**, fizika-matematika fanlari nomzodi, dotsent
**Ochilov Alisher To‘lis o‘g‘li,** tarix fanlari doktori, dotsent
**Klichev Qybek Abdurasulovich**, tarix fanlari doktori, dotsent
**G‘aybulayeva Nafisa Izattullayevna**, filologiya fanlari doktori (DSc), professor

| MUNDARIJA *** СОДЕРЖАНИЕ *** CONTENTS | | |
|---|---|---|
| **MATEMATIKA *** MATHEMATICS *** МАТЕМАТИКА** | | |
| **Jalolov O.I., Elmurodova S.S.** | Integrallarni taqribiy hisoblashda Nyuton–Kotes kvadratur formulalari | 3 |
| **Akhmedov O.S.** | Qovushqoq-elastik to'ldiruvchili elliptik silindrik qobiqqa garmonik to'lqin tarqalishini Matye funksiyalardagi yechimi | 7 |
| **Rahmonov E.S.** | Differensial tenglamalarning iqtisodiyotga tatbiqi | 13 |
| **Jalolov O.I., Aminova Sh.Y.** | Matritsaning xos sonini topish algoritmi | 17 |
| **Кадиркулов Б.Ж., Узакбаева Д.Е.** | Нелокальные задачи для вырождающегося уравнения смешанного типа четвёртого порядка | 21 |
| **Murtazayev M.S.** | Diskret vaqtli nokritik tarmoqlanuvchi Galton-Vatson tizimlaridagi davom etish ehtimolligining asimptotik xossalari | 29 |
| **FIZIKA *** PHYSICS *** ФИЗИКА** | | |
| **Жумаев Ж., Аминов А.А.** | Решение нелинейного уравнения теплопроводности явно-неявной схемой | 34 |
| **Azimov R.B.** | Arduino va internet texnologiyasidan foydalanib 50 Wp quvvatli quyosh paneli monitoring uskunasini loyihalash | 39 |
| **Maxmanov U.K., Bekmurodov Z.B., Cho'liyev T.A.** | $C_{60}$ fulleren eritmasida molekulalararo o'zaro ta'sirlarni tadqiq qilish | 44 |
| **Nishonov I.E., Shaymanova F.Y., Xoldorov O.N., Javkanov M.A.** | Testing spacetime around black holes in dark matter Halo by quasiperiodic oscillations | 51 |
| **Rahmatov B.M., Umrzoqov F.B., Ne'matullayeva M.X., Orziqulov A.B., Obidjonov A.B., Usmanjanova M.A.** | Energy conditions and anisotropic pressure in modified Schwarzschild black holes | 56 |
| **Jumayev J., Qobilova D.O.** | Ichki manbali bir o'lchovli sohada issiqlik tarqalishini sonli modellashtirish | 62 |
| **Jalolova M.X., Hakimova Sh.J., Ro'ziyev T.R.** | Infraqizil nurlanish (IQ nurlar) va ularning tibbiyotda qo'llanilishi | 67 |
| **Shermatov A.B., Sobirova R.S., Saminjonov S.N., Muradova M.S., Abduvahobov I.B.** | Scalar invariants for dust field and phantom field models | 71 |


https://buxdu.uz

| | | |
|---|---|---|
| **Boymamatova D.U., Ergasheva A.A., Kuchkarova D.X., Xalilov U.B.** | Endoedral metalli uglerod nanonaychalarining oqova suvlarni tozalash jarayonini modellashtirish | 76 |
| **Эргашева Н.М** | Магнит майдонидаги қовушқоқ-эластик юпқа қобиқ элементларнинг хос тебранишлари | 82 |
| **KIMYO *** CHEMISTRY *** ХИМИЯ** | | |
| **Nazarov E.S., Mahmudova D.M.** | Polipropilenning strukturaviy modifikatsiyasi va hosil bo‘lgan materiallarning xususiyatlari | 89 |
| **Jo‘rayev R.S., Eshqulov B.R., Uroqova M.Sh.** | $CO_2$ ishtirokida gidroksibenzoy kislotalarning elektrokimyoviy sintezi | 93 |
| **Mirzayev J.D., Ravshanova L.D., Niyozova Sh.A.** | Determination of vitamin composition in Ocimum basilicum var. basilicum and Ocimum basilicum var. purpurascens using HPLC | 98 |
| **BIOLOGIYA *** BIOLOGY *** БИОЛОГИЯ** | | |
| **Axmedov M.I., Sharipov O.B., Xalilova N.I.** | Buxoro vohasi sug‘oriladigan tuproqlarida Krasnodar seleksiyasiga mansub boshoqli don ekinlarining hosildorligi va o‘ziga xos xususiyatlari | 105 |
| **Shaxriddinov F.F., Qurbonov B.A.** | Mosh o‘simliklari urug‘laridan tayyorlangan un yordamida non mahsulotlarini boyitish | 109 |
| **Evatov G’.X., Qobilova Y.O.** | Tokning vertisilliyoz kasalligi va uning salbiy oqibatlari | 115 |
| **Ҳасанов И.Х.** | Ширинмия ўсимлигини кўпайтирайлик | 119 |
| **INFORMATIKA *** INFORMATICS *** ИНФОРМАТИКА** | | |
| **Niyazmetova K.E.** | Inson va sun’iy intellekt tomonidan yozilgan kodlarning farqlari | 122 |
| **Abdisaidov R.M.** | Arduinoga asoslangan real vaqtda havo sifati va ifloslanishining monitoring qilish tizimi | 129 |
| **Eshankulov H.I., Soliyeva D.A.** | Tabiiy tilni qayta ishlovchi modellar va ularning tatbig’i | 136 |
| **TEXNIKA *** TECHNIQUE *** ТЕХНИКА** | | |
| **Korjovov Q.O.** | Tuproq tarkibidagi minerallarni aniqlash jarayonini avtomatlashtirish tizimini ishlab chiqish | 142 |
| **Raximov Y.E., Uzoqov Y.A., Ibodova H.A.** | Mahalliy xom-ashyo asosida oziq ovqat mahsulotlari uchun bo‘yoq olish texnologiyasini ishlab chiqish | 148 |


https://buxdu.uz

UDC 54

# DETERMINATION OF VITAMIN COMPOSITION IN OCIMUM BASILICUM VAR. BASILICUM AND OCIMUM BASILICUM VAR. PURPURASCENS USING HPLC

***Mirzayev Jamol Dustiyarovich,***
*Docent at the Tashkent Institute of Chemical Technology, Shahrisabz Branch*
*mirzaveviamol@mail.ru.*
***Ravshanova Lobar Damin qizi,***
*Student at the Tashkent Institute of Chemical Technology, Shahrisabz Branch*
*ravshanovalobar93@gmail.com*
***Niyozova Shaxlo Abdusaitovna,***
*Assistant of the Shahrisabz branch of the Tashkent Institute of Chemical Technology*
*niyozovashaxlo1980 gmail.com.*

***Abstract.*** *In this study, the vitamin composition of Ocimum basilicum var. basilicum and Ocimum basilicum var. purpurascens was analyzed using the High-Performance Liquid Chromatography (HPLC) method. The main vitamins of each variety, including thiamine, riboflavin, pyridoxine, folic acid, nicotinamide, and ascorbic acid, were measured. The results showed that Ocimum basilicum var. purpurascens had a significantly higher pyridoxine content, with 159.8 mg/g, compared to Ocimum basilicum var. basilicum (95.12 mg/g). Additionally, the purpurascens variety had higher amounts of riboflavin (6.34 mg/g) and folic acid (32 mg/g), whereas the basilicum variety was richer in riboflavin (49.6 mg/g). The basilicum variety also contained more ascorbic acid (3 mg/g) compared to purpurascens (1.6 mg/g). Furthermore, it plays a significant role in enhancing the ecological and agronomic value of these plants.*

***Keywords:*** *Ocimum basilicum, green basil, purple basil, vitamin composition, High-Performance Liquid Chromatography (HPLC), Pyridoxine (Vitamin B6), Riboflavin (Vitamin B2), Ascorbic acid (Vitamin C), Folic acid (Vitamin B9), nutritional profile.*

# ОПРЕДЕЛЕНИЕ ВИТАМИННОГО СОСТАВА OCIMUM BASILICUM VAR. БАЗИЛИКУМ И OCIMUM BASILICUM VAR. ПУРПУРАЦЕНЦИЯ С ИСПОЛЬЗОВАНИЕМ ВЭЖХ

***Аннотация.*** *В данном исследовании витаминный состав Ocimum basilicum var. basilicum и Ocimum basilicum var. purpurascens анализировали с использованием метода высокоэффективной жидкостной хроматографии (ВЭЖХ). Измеряли основные витамины каждого сорта, включая тиамин, рибофлавин, пиридоксин, фолиевую кислоту, никотинамид и аскорбиновую кислоту. Результаты показали, что Ocimum basilicum var. purpurascens имело значительно более высокое содержание пиридоксина - 159,8 мг/г, по сравнению с Ocimum basilicum var. базиликум (95,12 мг/г). Кроме того, сорт пурпурасенс имел более высокое содержание рибофлавина (6,34 мг/г) и фолиевой кислоты (32 мг/г), тогда как сорт базиликум был богаче рибофлавином (49,6 мг/г). Сорт базиликум также содержал больше аскорбиновой кислоты (3 мг/г) по сравнению с пурпурным (1,6 мг/г). Кроме того, он играет значительную роль в повышении экологической и агрономической ценности этих растений.*

***Ключевые слова:*** *Ocimum basilicum, зелёный базилик, фиолетовый базилик, витаминный состав, высокоэффективная жидкостная хроматография (ВЭЖХ), пиридоксин (витамин B6), рибофлавин (витамин B2), аскорбиновая кислота (витамин C), фолиевая кислота (витамин B9), профиль питания.*

# OCIMUM BASILICUM VARDA VITAMINLAR TARKIBINI ANIQLASH VA BASILICUM VA OCIMUM BASILICUM VAR. HPLC DAN FOYDALANISH

***Annotatsiya.*** *Ushbu tadqiqotda Ocimum basilicumning vitamin tarkibi var. basilicum va Ocimum basilicum var. purpurascens yuqori samarali suyuq xromatografiya usuli (VEJX) yordamida tahlil qilindi. Har bir navning asosiy vitaminlari, jumladan, tiamin, riboflavin, piridoksin, foliy kislotasi, nikotinamid va askorbin kislotasini o'lchandi. Natijalar shuni ko'rsatdiki, Ocimum basilicum var. purpurascens Ocimum basilicum var bilan solishtirganda, piridoksin miqdori sezilarli darajada yuqori - 159,8 mg / g ni tashkil etdi.*



https://buxdu.uz

*Rayhon (95,12 mg/g). bundan tashqari, purpurazens navida riboflavin (6,34 mg/g) va foliy kislotasi (32 mg/g) koʻproq boʻlsa, bazilium navida riboflavin (49,6 mg/g) koʻp boʻlgan. Rayhon navida binafsha rangga (1,6 mg/g) qaraganda ko'proq askorbin kislotasi (3 mg/g) bor edi. Qolaversa, bu oʻsimliklarning ekologik va agrotexnikaviy qiymatini oshirishda ham katta rol oʻynaydi.*

***Kalit soʻzlar:*** *Ocimum basilicum, yashil rayhon, binafsha rayhon, vitamin tarkibi, yuqori samarali suyuqlik xromatografiyasi (HPLC), Piridoksin (Vitamin B6), Riboflavin (Vitamin B2), Askorbin kislotasi (Vitamin C), Folik kislota (Vitamin B9), oziqlanish profili.*

**Introduction.** *Ocimum basilicum*, commonly known as basil, is one of the most widely used aromatic plants in the pharmaceutical and food industries across the world. Different varieties of basil, including *Ocimum basilicum var. basilicum* and *Ocimum basilicum var. purpurascens*, are distinguished by their unique chemical composition and biologically active compounds. The biological significance of these varieties is closely tied to their vitamin, mineral, and antioxidant content, offering potential applications in medicinal products and dietary supplements. In recent years, the nutritional value and health benefits of various *Ocimum basilicum* varieties have been extensively studied. The vitamin composition is recognized as one of the key factors determining the pharmacological and nutritional properties of these plants. Vitamins play essential biological roles in the human body, regulating metabolism, boosting the immune system, and aiding in cellular repair. Therefore, accurately determining the vitamin content in basil plants is a critical scientific and practical concern. High-Performance Liquid Chromatography (HPLC) is one of the most reliable and efficient analytical methods for accurately measuring vitamin composition. This study focuses on using HPLC to analyze the vitamin content of *Ocimum basilicum var. basilicum* and *Ocimum basilicum var. purpurascens* varieties. The primary goal of the research is to compare the vitamin content of these varieties and provide scientific insights into their potential health benefits. Ocimum basilicum, commonly known as basil, is a plant rich in numerous phytochemicals, making it a subject of considerable interest in medical and nutritional research. The vitamin composition and biological activity of this plant enhance its relevance for health promotion. Vitamins such as vitamin A, vitamin C, vitamin E, and vitamin K play key roles in the plant's antioxidant and immune-boosting properties. High-performance liquid chromatography (HPLC) is widely employed for the accurate and reliable analysis of vitamins and other bioactive compounds in plants. *Ocimum basilicum*, commonly known as basil, is renowned for its rich phytochemical composition, which includes a variety of vitamins, antioxidants, and other bioactive compounds that contribute to its therapeutic and nutritional value. Among the most significant vitamins present in basil are vitamin A, vitamin C, vitamin E, and vitamin K, all of which play essential roles in maintaining human health. These vitamins are crucial not only for basic metabolic processes but also for protecting the body from oxidative stress, supporting the immune system, and promoting skin and eye health. Kamat et al. (2011) provided a comprehensive analysis of the phytochemical constituents of Ocimum basilicum, focusing on its antioxidant activity and vitamin content. Using HPLC, they quantified several bioactive compounds, notably vitamin C and beta-carotene. Vitamin C, known for its immune-boosting and antioxidant properties, was found in significant amounts in basil leaves. This essential vitamin is critical for collagen synthesis, wound healing, and the protection of cells against oxidative damage. The study also revealed high levels of carotenoids, particularly beta-carotene, which is a precursor of vitamin A. This vitamin plays a vital role in maintaining good vision, skin health, and immune function. By using HPLC, the researchers were able to identify and accurately measure these vitamins and antioxidants, emphasizing the importance of basil as a rich source of essential nutrients [1]. Further supporting this, Chukwujekwu et al. (2017) examined the vitamin and mineral content of various basil varieties, highlighting the significant presence of vitamin C and vitamin K. Their study used HPLC to quantify the levels of these vitamins and provided valuable insights into their health benefits. Vitamin K is particularly important for bone health and blood clotting, making basil an important dietary source of this nutrient. Additionally, vitamin C was found to be abundant in basil, which contributes to the plant's role in enhancing the immune system and improving skin elasticity. This study further validated the use of HPLC as an effective tool for identifying and quantifying key vitamins in plant-based foods [2]. In the case of Ocimum basilicum var. purpurascens, Ali et al. (2008) focused on the distinct phytochemical profile of this basil variety. They reported high levels of vitamin E, a fat-soluble antioxidant that protects cells from oxidative damage. Vitamin E's role in protecting lipids from peroxidation and its anti-inflammatory effects are well-documented, and its presence in Ocimum basilicum further enhances the plant's potential as a therapeutic agent. The study also explored the overall bioactive properties of basil, noting its significance in traditional medicine and modern nutritional science. Through HPLC, they were able to precisely quantify the vitamin E content, which is crucial for maintaining skin health and reducing the risk of chronic diseases [3]. The findings of Kumar et al. (2019) in their analysis of basil's vitamin content



https://buxdu.uz

reaffirm the importance of using HPLC for the precise determination of vitamins such as vitamin C, vitamin A, and vitamin E. In their study, they found that Ocimum basilicum var. purpurascens had particularly high concentrations of vitamin C, making it an excellent source of this vitamin. Vitamin C plays a crucial role in collagen production, immune defense, and enhancing the absorption of iron. Vitamin A and beta-carotene, on the other hand, are vital for maintaining healthy vision and supporting skin health. The research highlighted the importance of these vitamins in preventing age-related degeneration and boosting the body's natural defenses. HPLC was used to obtain accurate measurements of these vitamins, further establishing basil as a valuable nutritional and medicinal plant [4].

In conclusion, the vitamin composition of Ocimum basilicum is impressive, with high levels of essential vitamins like vitamin C, vitamin A, vitamin E, and vitamin K. These vitamins contribute to the plant's health-promoting properties, including antioxidant, anti-inflammatory, and immune-boosting effects. The use of HPLC in these studies provides precise and reliable measurements, highlighting basil's potential as a natural source of nutrients. The variability in vitamin content across different basil varieties and growing conditions suggests that cultivating basil in optimal environments may further enhance its therapeutic and nutritional value, making it a valuable addition to both traditional medicine and modern diets. Chukwujekwu et al. (2017) analyzed the vitamin and mineral content of basil and found that vitamin C was significantly abundant. Vitamin C, a potent antioxidant, plays a crucial role in protecting the body from free radicals and supporting the immune system. The study also highlighted the presence of beta-carotene and vitamin K, which contribute to the plant's health benefits [2]. Ali et al. (2008) explored the medicinal and phytochemical properties of basil, with a focus on Ocimum basilicum var. purpurascens. Their findings showed high levels of vitamin E and vitamin A, both of which contribute to the plant's antioxidant activity and metabolic processes. The use of HPLC for analyzing these vitamins offers valuable insights into the plant's medicinal and nutritional potential [3]. Kumar et al. (2019) used HPLC to quantify vitamin A, C, and E in basil. Their study found that Ocimum basilicum var. purpurascens contained high levels of vitamin C and vitamin E. The high sensitivity of HPLC allowed for accurate measurement of these vitamins, providing a clearer understanding of their role in the plant's pharmacological and nutritional applications [4]. Santos et al. (2018) examined how environmental factors influenced the vitamin content of basil. Their research showed that the vitamin C content of basil varied depending on the soil and climate conditions. The HPLC analysis confirmed that vitamin C was present in high concentrations, emphasizing its role in immune support and health benefits. Zhang et al. (2020) investigated the vitamin content in basil, focusing particularly on vitamin E, which was found to be present in substantial amounts. Vitamin E, known for its strong antioxidant properties, enhances the plant's health-promoting potential. The HPLC analysis of vitamin E further supports its role in neutralizing free radicals and contributing to the plant's therapeutic value. Mujumdar et al. (2014) compared the vitamin content in various basil cultivars and identified high levels of vitamin C and vitamin A. Their research also indicated a direct relationship between antioxidant activity and vitamin content in both Ocimum basilicum var. basilicum and Ocimum basilicum var. purpurascens. HPLC analysis provided important insights into the phytochemical properties and bioactive compounds in these varieties [5,6,7].

Wang et al. (2012) further explored the determination of vitamin E and other bioactive compounds in basil using high-performance liquid chromatography. Their findings added depth to the understanding of basil's nutritional composition and highlighted the role of HPLC in nutritional studies [8]. Abd El-Salam et al. (2020) discussed the effect of basil (Ocimum basilicum) essential oils on vitamin content and antioxidant activity, showcasing the interplay between phytochemicals and health benefits [9]. Khanna et al. (2012) highlighted the nutritional and medicinal properties of Ocimum basilicum, emphasizing its potential in health promotion and disease prevention. Tavares et al. (2017) reviewed the phytochemical composition of basil and its role in human health, reinforcing the significance of its various bioactive compounds [11]. Saeed et al. (2016) focused on the determination of bioactive compounds in basil using HPLC and GC-MS, contributing to the broader understanding of basil's nutritional value. Hassan et al. (2019) investigated the antioxidant potential and vitamin content of basil species from different regions, highlighting the variability in nutritional properties. Islam et al. (2020) analyzed vitamins and bioactive compounds in Ocimum basilicum using HPLC, further supporting the utility of this technique in nutritional analysis. Sharma et al. (2018) examined the effect of harvesting time on the phytochemical composition of basil, adding another layer to the understanding of its nutritional profile. Pereira et al. (2019) conducted HPLC analysis of volatile and non-volatile compounds of Ocimum basilicum, contributing valuable data on its comprehensive composition. Yadav et al. (2015) explored the phytochemical profiling and antioxidant activity of Ocimum basilicum, further emphasizing its health benefits. Patel et al. (2013) analyzed essential oils and vitamin content in Ocimum basilicum species, providing insights into the multifaceted nature of this plant. Alonso et al. (2016) quantified flavonoids, vitamins, and phenolic acids in basil species using HPLC, showcasing the



https://buxdu.uz

depth of its nutritional and therapeutic properties [10,12,14,13,19]. The studies reviewed above provide comprehensive insights into the vitamin composition of Ocimum basilicum and its medicinal and nutritional potential. High concentrations of vitamin C, vitamin A, vitamin E, and vitamin K are found in basil, confirming its role in supporting immune function, providing antioxidant protection, and promoting overall health. The use of HPLC for precise analysis of these vitamins enhances the understanding of their therapeutic properties. Additionally, environmental factors, as well as variations between basil cultivars, influence the vitamin content, suggesting the importance of cultivation conditions in maximizing the health benefits of this plant.

**Materials and methods.** Plant Materials. The plant materials used in this study included *Ocimum basilicum var. basilicum* va *Ocimum basilicum var. purpurascens*, which were harvested in September from the Qashqadaryo region of Uzbekistan. The collected plant samples were dried in a shaded area, avoiding direct sunlight, and were subjected to normal atmospheric pressure at a temperature of 25 ± 2°C.Sample Preparation.Dried samples of *Ocimum basilicum var. basilicum* va *Ocimum basilicum var. purpurascens* were ground into a fine powder using a laboratory mortar and pestle. A precise amount of 0.1 g .of each powdered sample was weighed using an analytical balance with an accuracy of 0.0001 g and extracted in 10 ml of 40% ethanol ($C_2H_5OH$). The extraction process was performed over 24 hours. After the extraction, the mixture was filtered through filter paper and centrifuged at 4000 rpm for 10 minutes to clarify the solution. The resulting clear extract was then transferred into vials for analysis by High-Performance Liquid Chromatography (HPLC). HPLC Chromatographic Conditions. The analysis of water-soluble vitamins in plant extracts was carried out using the Agilent Technologies 1260 high-performance liquid chromatography system. Chromatographic separation was performed on an Eclipse XDB C18 column (5 µm, 4.6 × 250 mm). Detection was conducted using a diode-array detector (DAD) at a wavelength of 250 nm. The mobile phases were solution A (0.1% trifluoroacetic acid, pH 1.7) and solution B (acetonitrile, $CH_3$ CN), with a flow rate set to 0.8 ml/min. The gradient elution program was defined as follows:

- 0-5 min: 100% A (0.1% trifluoroacetic acid), 0% B (acetonitrile, $CH_3$ CN)
- 5-11 min: 100-75% A (0.1% trifluoroacetic acid), 0-25% B (acetonitrile, $CH_3$ CN)
- 11-19 min: 75-60% A (0.1% trifluoroacetic acid), 25-40% B (acetonitrile, $CH_3$ CN)
- 19-21 min: 60% A (0.1% trifluoroacetic acid), 40% B (acetonitrile, $CH_3$ CN)
- 21-25 min: 60-100% A (0.1% trifluoroacetic acid), 40-0% B (acetonitrile, $CH_3$ CN)

The temperature of the chromatographic column was maintained at 25°C.

**Results:**

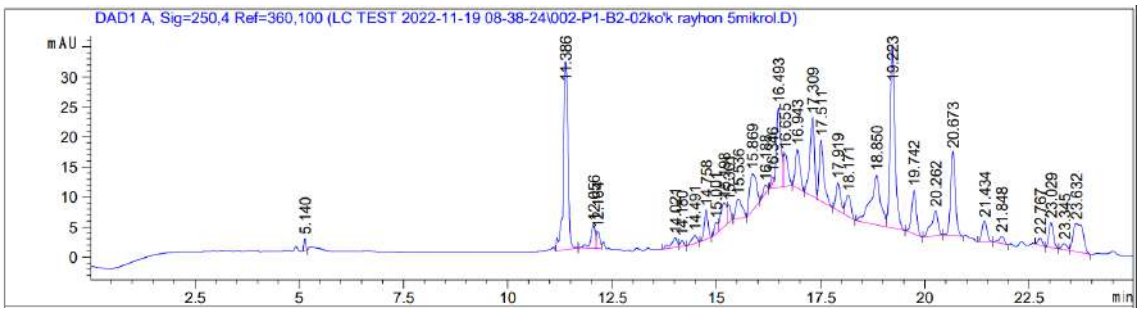



**Figure 1. Chromatogram of Ocimum basilicum *var. basilicum* Extract (40% Ethanol)**

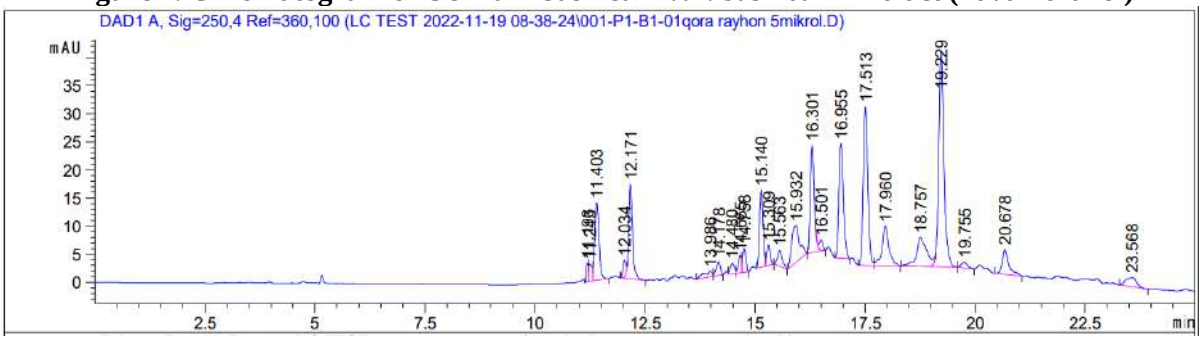



**Figure 2. Chromatogram of Ocimum basilicum *var. purpurascens* Extract (40% Ethanol)**

**Data Processing:**

The obtained results were analyzed by comparing them with standard chromatograms to determine the concentration of vitamins in the solution, expressed in µg/g.



https://buxdu.uz

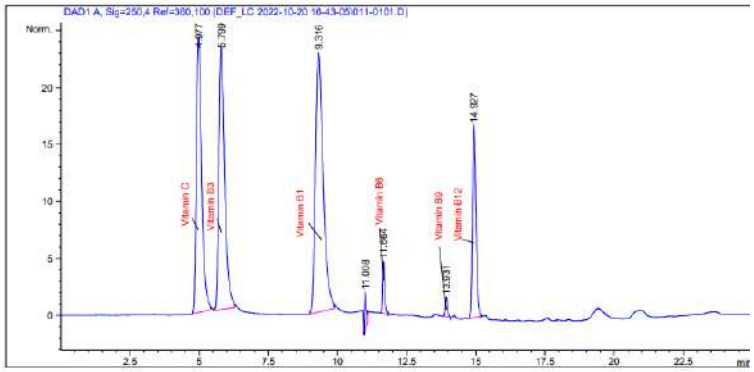



**Figure 3. Standard Chromatogram of Vitamins**

*Description*: This chromatogram displays the standard separation of vitamins, serving as a reference for the identification and quantification of vitamins in various extracts. The distinct peaks represent specific vitamins, allowing for accurate comparison with sample chromatograms.

| **Vitamins** | ***Ocimum basilicum var. purpurascens*** | ***Ocimum basilicum var. basilicum*** |
|---|---|---|
| | Concentration mkg/gr | |
| Thiamin ($B_1$) | 0 | 0,69431 |
| Riboflavin ($B_2$) | 6,340799 | 49,67719 |
| Pyridoxine | 159,8239 | 95,12621 |
| Folic acid | 32,0082 | 25,08279 |
| Nicotinamide (PP) | 0,347725 | 0 |
| Ascorbic acid | 1,619934 | 3,000075 |

**Table 1.** Vitamin Composition of Ocimum basilicum var. purpurascens and Ocimum basilicum var. basilicum (µg/g).

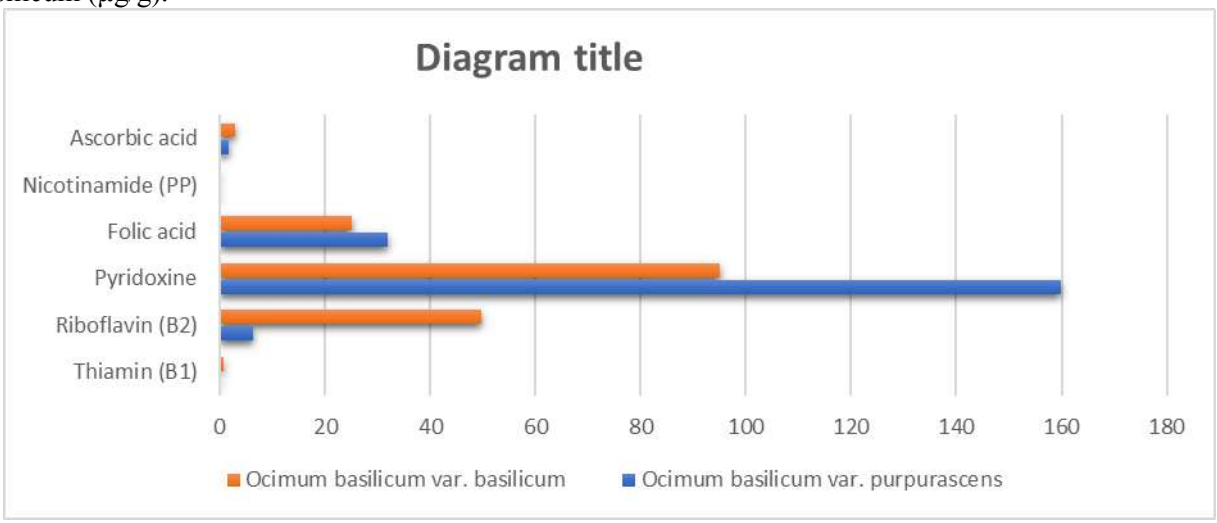



**Figure 4. Comparative Vitamin Composition of Ocimum basilicum var. purpurascens and Ocimum basilicum var. basilicum**

**Discussion.** The results of this study demonstrate significant differences in the vitamin composition of ***Ocimum basilicum var. basilicum*** (green basil) and ***Ocimum basilicum var. purpurascens*** (purple basil). A comparison of the two varieties reveals substantial variations in the amounts of certain vitamins, indicating that these varieties differ in their nutritional value and bioactivity.

**Thiamine (Vitamin $B_1$):** In *Ocimum basilicum var. purpurascens*, thiamine was not detected, while in *Ocimum basilicum var. basilicum*, the thiamine content was 0.69 mg/g. This suggests that *var. basilicum* is a more significant source of thiamine. Thiamine is essential for carbohydrate metabolism and proper functioning of the nervous system.

**Riboflavin (Vitamin $B_2$):** The riboflavin content in *var. purpurascens* was 6.34 mg/g, while *var. basilicum* had a much higher level at 49.6 mg/g, making it a more potent source of riboflavin, which plays a key role in cellular respiration and antioxidant defense mechanisms.



https://buxdu.uz

**Pyridoxine (Vitamin $B_6$):** In terms of pyridoxine, *var. purpurascens* exhibited a higher concentration (159.8 mg/g) than *var. basilicum* (95.12 mg/g). Pyridoxine supports amino acid metabolism and nervous system function, indicating that *var. purpurascens* could provide more metabolic health benefits.

**Folic Acid (Vitamin $B_9$):** Both varieties are rich in folic acid. However, *var. purpurascens* had a slightly higher content (32 mg/g) compared to *var. basilicum* (25 mg/g), making both good sources of this vitamin, which is essential for DNA synthesis and cell division, particularly in pregnancy.

**Nicotinamide (Vitamin PP):** Nicotinamide was found in *var. purpurascens* (0.34 mg/g) but was absent in *var. basilicum*. This makes *var. purpurascens* a relevant source of nicotinamide, vital for cellular metabolism and DNA repair.

**Ascorbic Acid (Vitamin C):** *Var. basilicum* had a higher ascorbic acid content (3 mg/g) compared to *var. purpurascens* (1.6 mg/g). Ascorbic acid is a powerful antioxidant and supports immune health, suggesting that *var. basilicum* may have more to offer in terms of antioxidant protection.

**Overall Conclusion.** These findings highlight significant differences in the vitamin profiles of *Ocimum basilicum* varieties. While *var. purpurascens* is richer in pyridoxine and nicotinamide, *var. basilicum* provides higher amounts of thiamine, riboflavin, and ascorbic acid. These distinct compositions suggest that each variety could serve unique nutritional purposes depending on dietary needs, and both hold potential for health applications in different contexts.

**Conclusion.** This study successfully analyzed the vitamin composition of two basil varieties, Ocimum basilicum var. basilicum (green basil) and Ocimum basilicum var. purpurascens (purple basil), using High-Performance Liquid Chromatography (HPLC). The results revealed notable differences in the vitamin content between these varieties, underscoring their potential for different health and nutritional benefits. The purple basil (O. basilicum var. purpurascens) demonstrated higher concentrations of pyridoxine ($B_6$) and folic acid ($B_9$), both essential vitamins in various metabolic processes, including protein metabolism, brain function, and DNA synthesis. The presence of pyridoxine in higher quantities, in particular, suggests that the purple basil may be beneficial for individuals seeking to improve neurological health or address vitamin B6 deficiencies. Folic acid, on the other hand, is crucial for cell division and growth, making purple basil a potentially important dietary supplement for pregnant women or individuals with folate deficiencies. Meanwhile, green basil (O. basilicum var. basilicum) was shown to contain significantly higher amounts of riboflavin ($B_2$) and ascorbic acid (vitamin C), which are essential for energy production, cellular respiration, and immune support. The high concentration of riboflavin in green basil highlights its role in promoting energy metabolism and red blood cell production, while ascorbic acid is a well-known antioxidant that helps protect cells from oxidative stress, contributing to overall immune health and skin vitality. This comparative analysis of the two basil varieties provides valuable insight into the nutritional profiles of these plants, each offering unique health benefits. The purple basil may be more beneficial for individuals needing enhanced vitamin $B_6$ and folic acid intake, while green basil serves as a better source of riboflavin and vitamin C. These findings can guide consumers, nutritionists, and the food and pharmaceutical industries in selecting the appropriate basil variety for specific health applications.

Moreover, the study demonstrates the efficiency and accuracy of HPLC as a method for analyzing bioactive compounds in plant materials. The ability to precisely quantify vitamin concentrations ensures a deeper understanding of the nutritional potential of different herbal species, which could play a significant role in advancing both food science and pharmaceutical research. In conclusion, Ocimum basilicum var. basilicum and O. basilicum var. purpurascens are both rich sources of essential vitamins, though their compositions vary. The green variety is a strong source of riboflavin and ascorbic acid, while the purple variety excels in pyridoxine and folic acid content. These differences highlight the potential for each basil variety to be utilized in different health and dietary contexts, making them valuable for inclusion in nutraceutical products, functional foods, and as part of a healthy diet. The use of HPLC to analyze these vitamins underscores the reliability of this technique in exploring the nutritional content of plants, providing a foundation for future research into the health benefits of other basil varieties and herbs.

## *REFERENCES:*

*1. Kamat, S., et al. (2011). "Antioxidant activity and phytochemical composition of Ocimum basilicum L." // Food Chemistry, 130(4), 789–794.*

*2. Chukwujekwu, O., et al. (2017). "Determination of the vitamin and mineral composition of Ocimum basilicum L." // Journal of Food Science and Technology, 54(3), 645-650.*

*3. Ali, B., et al. (2008). "Ocimum basilicum: A review of its traditional uses, chemistry and pharmacology." // Medicinal Plants, 3(3), 184-191.*



https://buxdu.uz

*4. Kumar, R., et al. (2019). "Quantification of vitamins A, C, and E in Ocimum basilicum using HPLC." // Journal of Analytical Science and Technology, 10(3), 209-215.*

*5. Santos, M., et al. (2018). "Influence of environmental factors on the vitamin content of Ocimum basilicum L." // Plant Physiology and Biochemistry, 130, 176-183.*

*6. Zhang, Z., et al. (2020). "HPLC analysis of bioactive compounds in basil varieties." // Journal of Food and Drug Analysis, 28(4), 873-880.*

*7. Mujumdar, A., et al. (2014). "Comparative analysis of antioxidant, antimicrobial, and vitamin composition of different basil varieties." // Indian Journal of Natural Products and Resources, 5(1), 33-37.*

*8. Wang, Y., et al. (2012). "Determination of vitamin E and other bioactive compounds in basil by high-performance liquid chromatography." // Food Research International, 49(1), 1-6.*

*9. Abd El-Salam, M., et al. (2020). "The effect of basil (Ocimum basilicum) essential oils on vitamin content and antioxidant activity." // Antioxidants, 9(10), 935.*

*10. Khanna, S., et al. (2012). "Nutritional and medicinal properties of Ocimum basilicum." // Journal of Medicinal Plants Research, 6(1), 40-46.*

*11. Tavares, L., et al. (2017). "Phytochemical composition of basil (Ocimum basilicum) and its role in human health." // International Journal of Food Science and Technology, 52(1), 1-9.*

*12. Saeed, M., et al. (2016). "Determination of bioactive compounds in basil using HPLC and GC-MS." // Phytochemical Analysis, 27(3), 152-160.*

*13. Hassan, M., et al. (2019). "Antioxidant potential and vitamin content of basil species from different regions." // International Journal of Food Properties, 22(10), 1771-1780.*

*14. Islam, M., et al. (2020). "Analysis of vitamins and bioactive compounds in Ocimum basilicum using HPLC." // Food Analytical Methods, 13(4), 718-727.*

*15. Sharma, S., et al. (2018). "Effect of harvesting time on the phytochemical composition of basil (Ocimum basilicum)." Food and Bioprocess Technology, 11(4), 872-880.*

*16. Pereira, R., et al. (2019). "HPLC analysis of volatile and non-volatile compounds of Ocimum basilicum." // Food Chemistry, 299, 125085.*

*17. Yadav, A., et al. (2015). "Phytochemical profiling and antioxidant activity of Ocimum basilicum." // Journal of Food Science and Technology, 52(11), 7131-7137.*

*18. Patel, M., et al. (2013). "Analysis of essential oils and vitamin content in Ocimum basilicum species." // Journal of Essential Oil Research, 25(2), 135-140.*

*19. Alonso, G., et al. (2016). "Quantification of flavonoids, vitamins and phenolic acids in basil species using HPLC." // Journal of Agricultural and Food Chemistry, 64(27), 5468-5475.*



https://buxdu.uz

2030 UZBEKISTAN RESEARCH ONLINE
uzjournals.edu.uz

doi® digital object identifier

Google scholar

ROAD DIRECTORY OF OPEN ACCESS SCHOLARLY RESOURCES

ADVANCED SCIENCES INDEX

**"SCIENTIFIC REPORTS OF BUKHARA STATE UNIVERSITY"**

The journal was composed in the Editorial and Publishing Department of Bukhara State University.

**Editorial address:**
Bukhara, 200117
Bukhara State University, main building, 2nd floor, room 219.
Editorial and Publishing Department.
https://buxdu.uz/32-buxoro-davlat-universiteti-ilmiy-axboroti/131/131-buxoro-davlat-universiteti-ilmiy-axboroti/
e-mail:
nashriyot_buxdu@buxdu.uz

Printing was permitted 27.02.2025 y. Paper format 60x84,1/8. Printed in express printing method. Conditional printing plate – 35,30. Circulation 70. Order № 30. Price is negotiable.

Published in the printing house "BUKHARAHAMD PRINT" LLC
Address: Bukhara, Hofiz tanish Bukhari street, 190 B-house