E3S Web of Conferences **539**, 01014 (2024) https://doi.org/10.1051/e3sconf/202453901014
RSE-III-2024

Elaeagnus macrophylla Thunb. leaf morphology and chemical composition

L U Norkulova[1*], *D B* Fayzullayeva[1], *Z M* Kurbonova[2], *N Z* Rajamuradova[3], and *J M* Khursandov[1]

[1]Samarkand State University named after Sharof Rashidov, Samarkand, 140163, Uzbekistan
[2]Termez State University, Surkhandaryo, 190111, Uzbekistan
[3]Uzbekistan - Finland Pedagogical Institute, Samarkand, Uzbekistan

Abstract. This article presents data on leaf morphology and total oil and carbohydrate content of *Elaeagnus macrophylla* Thunb. It contains information on ways to determine the importance of plants with essential oil in medicine and economy, modern methods.This article also provides information on monosaccharides, oligosaccharides, and polysaccharides. Also information about the importance and properties of carbohydrates is provided.

1 Introduction

All flowering plants on earth belong to 300 families, of which 2,500 species from 87 families have been found to contain essential oils. In the flora of the CIS countries, there are more than 1100 species of essential oil plants belonging to 77 families. Most of them are distributed in the dry subtropics. 150–200 types of essential oils of industrial importance occupy an important place in the cosmetics, perfumery, food, and pharmaceutical industries [17]. The demand for medicinal, nutritious and ornamental plants is increasing day by day [3-4, 9-10]. It is important to study the chemical composition of medicinal plants[11-13, 15].

Although the properties and components of essential oils have been studied since the 18th century, the work in this field has especially intensified in the second half of the 19th century and the beginning of the 20th century. A.M. Butlerov and A.N. Reformatsky (Russia), E. Ye. Wagner and his students (Poland), and other famous scientists made a great contribution to the study of essential oils [17].

Essential oils are found in plant organs from 10.0% to 20-22% (carnation buds) and in some plants in small amounts (0.01–1.0%), although they are found. Essential oils accumulate in special places (tubules) of cells and tissues in various organs of plants (leaf, stem, flower, fruit, seed, and root). In addition, they are found in the form of emulsions in cell sap and parenchyma cells [4, 16, 20].

[*] Corresponding author: lobaruchqunovna@gmail.com

2 Materials and methods

Distributed in the middle latitudes of the Earth, Elaeagnaceae Juss. belongs to the family E. macrophylla Thunb of Elaeagnus L. E. macrophylla Thunb. The species was identified in 1784 by the Swedish botanist and naturalist researcher Carl Peter Thunberg. Macrophylla comes from the Greek words "makros," meaning large, and "phyllos," meaning leaf. That is why E. macrophylla is called big-leaved wild olive (Lox krupnolistnyy) [22].

The homeland of E. macrophylla Thunb. is Eastern China and South Korea (including Jeju-do), distributed in the subtropical region from central and southern Japan (Honsyu, Shikoku, Kyushu, and Okinawa) to Taiwan. a branched perennial evergreen shrub 2–8 meters tall. The branches are covered with long, red, brown, and hairy hairs. The leaves are 5–10 cm long, 4-6 cm wide, egg-shaped, with smooth edges that are hairy alternately. The leaf has white star trichomes and 6–8 pairs of lateral veins, forming an angle of 60–80°. Both sides of the young leaves emerging from the bud have a silver color, and then gradually their upper surfaces turn dark green. The flowers are very fragrant, pale yellow, 4-5 mm long, and bloom from October to November.1–8 bell-shaped or short oblong bell-shaped white flowers covered with orange dots are located on short branches in the leaf axils. The fruit is oblong, silvery, covered with small orange-yellow-dark red dots, 1.4–1.8 cm long, 5–6 mm in diameter, and 8 mm in diameter, with silk hairs inside. 6-7 mm in length. The fruits are red in color when they ripen in late spring or early summer [1].

E. macrophylla Thunb. can grow in dry, rocky, sandy, and salty soil in sunny and partially shaded places. It can even withstand temperatures of -15 ^{o}C. However, poorly maintained E. macrophylla Thunb. plants, like all types of plants, can suffer from chlorosis, which causes the leaves to turn yellow and quickly dry up. Psyllis (psyllid) larvae are also pests. In addition, honeydew falling on the buds and leaves causes the development of mold fungus [2].

As for the useful properties of E. macrophylla Thunb., the decoction prepared from its fruits is used for diarrhea, colitis, and stomach diseases, as well as respiratory tract diseases, and is used as an anti-inflammatory agent. It is also used in cosmetology. That is, it has an anti-inflammatory effect, helps with skin rashes, acts as a vitaminizer on the skin, and is washed with its decoction or tincture. Its flowers and leaves are used for this. Even for the perfumery industry, oil is produced from flowers [1, 7].

Currently, as a result of our research, we found that E. macrophylla Thunb, as an ornamental plant for the first time in Uzbekistan, was planted on the corridors of Dahbet road and Motrid street, Samarkand city, 39o39′20″N 66o58′13″E and 39º40'36"N 66º57'59"E, 2022, by the Department of Improvement of Samarkand city administration. Initially, there were about 200 bushes on the sidewalks of Dahbet Road and Motrid Street, and only 120–135 bushes of E. macrophylla Thunb. survived the abnormal cold of 2022. Currently, i.e., in 2023, these seedlings are growing rapidly (Figure 1).

E. macrophylla Thunb. The chemical composition of the leaves (carbohydrates and fats) was studied and determined in the Aziz Sanjar scientific laboratory of the Institute of Biochemistry of Samarkand State University, named after Sharof Rashidov. Semi-continuous solvent extraction methods (Soxhlet method) and phenol-sulfuric acid methods were used in this research.

Fig. 1. *Elaeagnus macrophylla* Thunb. A. Herbarium specimen of Elaeagnus macrophylla Thunb. B, C: Growth of *Elaeagnus macrophylla* Thunb. in the conditions of the city of Samarkand.

3 Results and Discussion

The first step in analyzing essential oils is to separate them. The traditional methods of extracting essential oils from plants are as follows: steaming, maceration, enflarage, pressing, and extraction. [6].

The method of driving using water or steam. In order to obtain essential oil according to this oldest and simplest method, crushed plant organs are placed in a cube (or in a laboratory flask) and water is poured over them. The cube (or flask) is then combined with a cooler and heated. Essential oil vapor passes through the cooler with water vapor, turns into a distillate in the form of cloudy water, and then falls into the receiver. After standing for a while, the distillate is collected either above or under water in specially made containers, depending on the density of the essential oil, and then the essential oil is extracted. The process of extracting essential oils using steam is as follows: Water vapor is created in a special tube or cube, and it is passed under the container with the plant organ. In this case, the water vapor takes on essential oil vapor and passes through the cooler. The vapors cool down, turn into liquid, and fall into special containers. When the essential oil is extracted with water, the plant body heats up along with the water. In this case, the plant organ may be slightly burned, and the quality of the essential oil may be slightly impaired. This phenomenon does not occur when essential oil is mixed with water vapor. Therefore, volatile essential oils are extracted from plants using steam [14].

Steam extraction is the most widely used method for extracting essential oils from plant organs. Pharmacopoeia XI edition recommended four methods of extracting essential oils from plant raw materials using water distillation. Glass tools of various constructions are used in these methods. This, in turn, makes it possible to accurately measure the volume of the separated oil up to ±0.02 ml [2].

The maceration method is based on the property of dissolving essential oils in fats. Therefore, this method is used for extracting essential oils whose composition changes when heated. Flowers containing essential oils are placed in a special container, and olive oil is poured over them.

The absorption method is based on the absorption of essential oils in solid oils. By this method, high-quality and stable essential oils are usually obtained from flowers. The absorption process is carried out at a normal temperature, so the composition of the essential oil remains intact and its quality is preserved. During the absorption process, which lasted for several days, the flowers continued to release essential oil. In order to obtain essential oils by this method, a thick window measuring 50x50 cm in height and width is installed on a special frame with a thickness of 5 cm. 'i) applied thinly. Flowers, or petals, are placed in the oil.The flowers on it are renewed every day. If the flowering period of the plant in the plantation lasts for more than 1-2 weeks, the oil on the glass will also be renewed. In this way, aromatic oil is prepared. These oils are used for special purposes.

It is obtained from products containing a large amount of essential oil (lemon, orange, and fruits of other plants) by pressing. A certain amount of essential oil is released even when the skin of the fruits of this plant is squeezed by hand. If you crack the essential oil areas with a toothed disk and squeeze the skin of the fruit, more oil will come out. Essential oil is also obtained in factories in the same way.

The extraction method is based on the good solubility of essential oils in most organic solvents. Essential oil is extracted from plant organs at low temperatures using a volatile organic solvent. Then the organic solvent is removed, and the essential oil is extracted. Extraction is carried out with boiling organic solvents (petroleum ether, diethyl ether, acetone, etc.). Extraction is often carried out in a Soxhlet-type apparatus for a period of time (sometimes up to several days). The obtained extract is collected by evaporation in a flow of inert gas or by reducing the pressure at low temperatures. The advantages of this method include the possibility of extracting thermolabile and low-volatile compounds from the sample; the disadvantages are the need to concentrate the extraction (which can lead to the loss of volatile substances); and the possibility of contamination of the gas chromatograph column with non-volatile compounds and their decomposition products [17, 21].

Essential oils are free in most plants and are extracted by extraction.That's why, in our research, We measured the amount of oil in the leaves of E. macrophylla Thunb using the semi-continuous solvent extraction (Soxhlet) method. In this method, we determined the oil content by reducing the weight of the sample or measuring the mass of the extracted oil. In this method, the solvent is first heated and volatilized. It was then condensed in the sample. The solvent is dripped onto the sample and must be wetted to extract the oil. The procedure was repeated several times by pouring the solvent into the heating flask for 15–20 minutes. Fat content was measured by the mass loss or fat weight of the sample. The result of the process is as follows: The oil content of 2 g of leaf sample is equal to 2.635% (Figure 2).

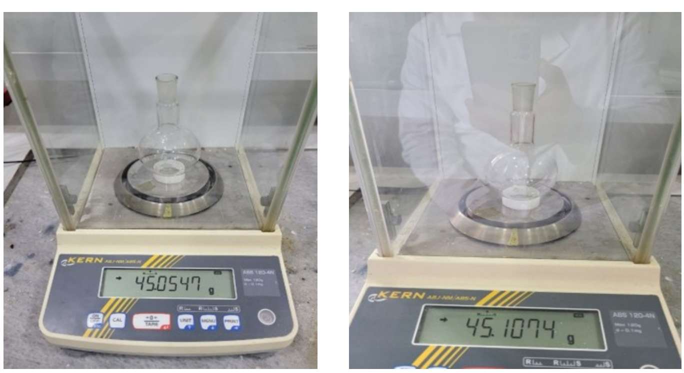

Fig. 2. The result of the extraction process. m(oil) = m(tube+oil) - m(tube) m(tube+oil) = 45.1074 gr m(tube) = 45.0547g m(oil) = 45.1074 - 45.0547 = 0.0527 gr (the amount of oil in 2 g of leaf sample) C% = 0.0527/2 ·100=2.635%.

Physical properties of essential oils: essential oils are often colorless or sometimes different colors (green, light yellow, dark blue, red, brown) with a specific smell and a sharp taste. volatile clear liquid, density, solubility in alcohol, number of acids and ethers, content of active substances, often lighter than water, sometimes heavier, density of very light essential oil is around 0.69-1.188 ladi [6].

Chemical composition of essential oils: essential oils are a mixture of organic substances, including all saturated and unsaturated compounds, aliphatic, cyclic, and aromatic hydrocarbons, terpenes, alcohols, fatty acids, phenols, complex ethers, aldehydes, ketones, lactones, and other organic substances containing nitrogen and sulfur [23].

There are several views and opinions about the function and importance of essential oils in plant organs, some of which will be discussed below. For example, according to some views, ether oils protect the plant from various diseases and pests. In addition, when plant tissue is damaged, it serves to prevent it from rotting and to regenerate. However, it is known from the literature and our personal observations that peppermint, marmarak, yongul tograyhan, arugula, and many other plants with essential oils usually suffer from various diseases and are damaged. There is a second opinion that essential oils protect plants from being eaten by animals. In addition, when plant tissue is damaged, it serves to prevent it from rotting and to regenerate. However, it is known from the literature and our personal observations that peppermint, marmarak, yongul tograyhan, arugula, and many other plants with essential oils usually suffer from various diseases and are damaged. There is a second opinion that essential oils protect plants from being eaten by animals. It should be said that we all know that cattle, sheep, and goats eat plants such as wormwood, tarragon, and lavender. There is also a third opinion that the essential oils in plant flowers attract insects and are pollinated by them. It should be said that we all know that cattle, sheep, and goats eat plants such as wormwood, tarragon, and lavender. There is also a third opinion that the essential oils in plant flowers attract insects and are pollinated by them. According to Tendal, essential oils evaporate, surround the plant, and block the path of hot air to a certain extent. As a result, it prevents the plant from overheating during the day, cools down at night, and also controls the evaporation of water in the plant. Sharobo says that essential oils are formed in plants as a reserve substance in their green parts. Then it begins to gradually move towards the organs that bear fruit. During the flowering period, part of them is consumed, and the rest returns to the leaves [19].

Since ancient times, people have been using the leaves, fruits, and seeds of various spices and essential oil plants in order to give food a food a good taste and pleasant aroma. Essential oils are widely used in the production of perfumes, toothpastes and powders, lipsticks, and soaps in the perfumery industry. In pharmaceuticals, some essential oils and their mixtures are used in the treatment of menthol, thymol, anethole, etc., and in the preparation of various (toothache, skin diseases, hair treatment) drugs due to their antiseptic properties [17].

It is also of great importance in the food industry. They are used in the production of candies, various buns, alcoholic and non-alcoholic drinks, wines, and liqueurs. Most of the essential oil plants are roses, hollyhocks, basils, and scallions, and lavender, coriander, marmarak, and hyssop are among the best honey plants [20].

Carbohydrates are divided into 3 categories.

Monosaccharides, or simple sugars. The general formula of monosaccharides is $(CH_2O)n$, which is equal to a number from 3 to 9. Monosaccharides can be divided into groups such as triose, pentose, tetrose, and hetose, depending on the number of atoms in the composition. Disaccharides are formed by the release of one molecule of water from two monosaccharides. Disaccharides include tregolose, lactose, and sucrose, which are widespread in nature. Glucose is sugar; fructose is fruit sugar; maltose is grain sugar; and lactose is milk sugar.

An oligosaccharide is a chain formed by joining two or more monosaccharides. One example of this is trisaccharides. A large number of glycosides of oligosaccharides are widely used in medicine.

Polysaccharides are complex carbohydrates consisting of a large number of monosaccharides whose molecules are linked by glycosidic bonds. Examples of polysaccharides are starch, inulin, glycogen, and hemicelluloses. Polysaccharides mainly act as reserves. Sucrose is stored in beets; mannitol in mushrooms; cellulose in cotton; and starch in potatoes. Another important function of polysaccharides is energy delivery. An interesting fact is that polysaccharides release 30 times more energy when the body breathes [1].

The practical importance of carbohydrates lies in the fact that substances necessary for the body, such as fructose, glucose, ascorbic acid, and antibiotics, are obtained from carbohydrates. Carbohydrate is the main raw material source in industry, medicine, pharmaceuticals, and the food industry. Also, paper, plastic, fibers, and explosives (parchment, lino paper) are made from carbohydrates [1].

Using the phenol-sulfuric acid method, we quickly and easily determined the amount of carbohydrates in the leaves of E. macrophylla Thunb. This method can detect almost all types of carbohydrates, including di-, mono-, and even oligo- and polysaccharides. The method is able to detect almost all types of carbohydrates. If it is not proven that only one type of carbohydrate is present in the sample, the results are calculated using a single carbohydrate. In this process, concentrated sulfuric acid is capable of breaking down all polysaccharides, disaccharides, and oligosaccharides into monosaccharides.Using the phenol-sulfuric acid method, we quickly and easily determined the amount of carbohydrates in the leaves of E. macrophylla Thunb. This method can detect almost all types of carbohydrates, including di-, mono-, and even oligo- and polysaccharides. The method is able to detect almost all types of carbohydrates. If it is not proven that only one type of carbohydrate is present in the sample, the results are calculated using a single carbohydrate. In this process, concentrated sulfuric acid is capable of breaking down all polysaccharides, disaccharides, and oligosaccharides into monosaccharides. The color produced by this reaction lasts for a long time, and under appropriate conditions, the accuracy of the procedure is within 2%. Carbohydrates (simple sugars, oligosaccharides, polysaccharides, and their derivatives) react under the influence of strong acid and heat, condense with phenol, and form furan derivatives, which form stable yellow-gold compounds that can be measured spectrophotometrically at 490 nm. Carbohydrates (simple sugars, oligosaccharides, polysaccharides, and their derivatives) react under the influence of strong acid and heat, condense with phenol, and form furan derivatives, which form stable yellow-gold compounds that can be measured spectrophotometrically at 490 nm [1].

D-glucose was used to generate the ranking graph. For this purpose, optical density values at 485 nm wavelength were used (Figure 3).

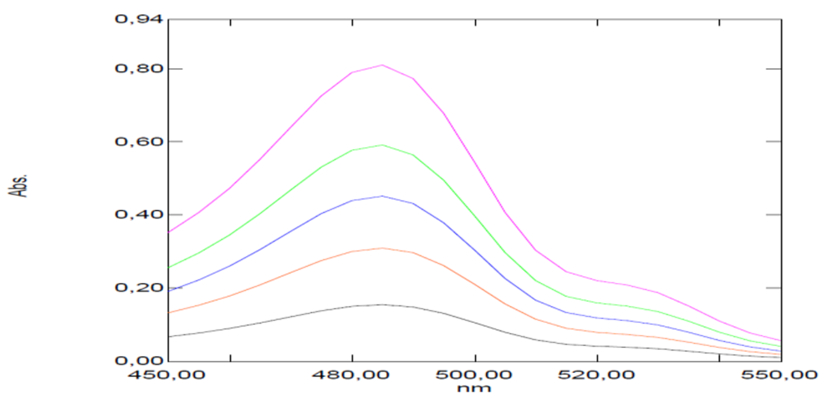

Fig. 3. Electronic absorption spectrum of D-glucose standard samples.

1 g of the sample was hydrolyzed under strongly acidic conditions (pH = 1), diluted 8 times, and the absorption spectrum was measured. A calibration curve was drawn using prepared standard samples (Figure 4).

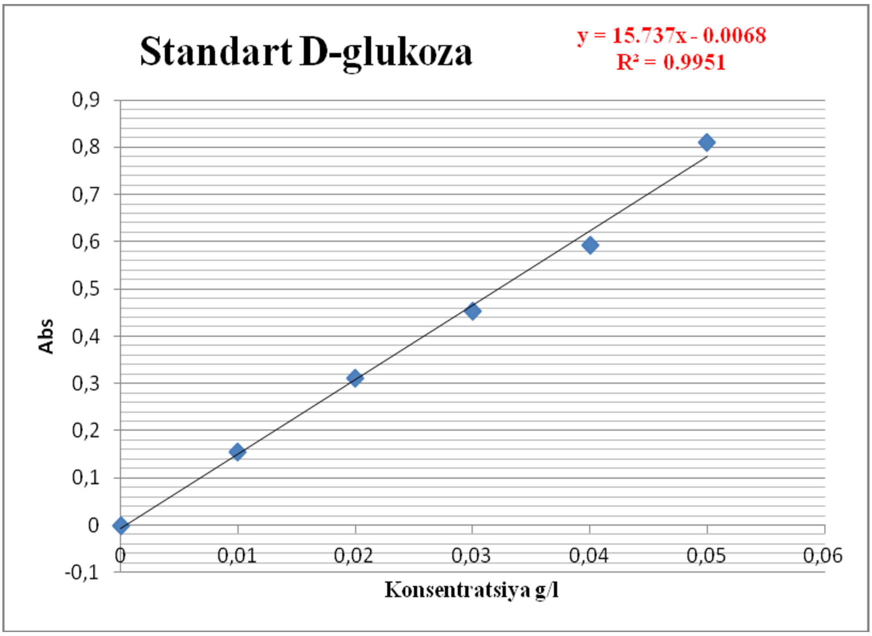

Fig. 4. Grading curve.

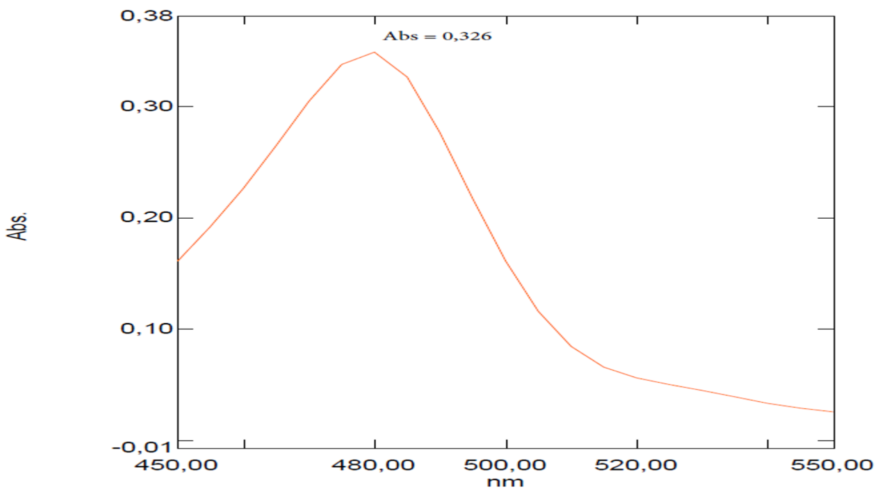

Fig. 5. Use of electrons and useful spectra.

The concentration of the samples was determined using a linear function (absorption versus concentration) generated using the standard.

y=15.737x–0.0068 y-Abs x-concentration (g/l) x=(y+0.0068)/15.737 y=0.326 x=0.021 g/l

y=15.737x – 0.0068 y-Abs x-concentration (g/l)

x=(y+0.0068)/15.737

y=0.326
x=0.021 g/l
If we take into account that the sample is diluted 8 times, it turns out that the amount of total carbohydrates in 1 g of leaves is 0.168 g. This sample was found to contain 16.8% carbohydrate relative to the total mass (Figure 5).

4 Conclusion

The results of our experiments showed that the group of organic compounds necessary for the life activity of human, animal, and plant organisms, such as carbohydrates and oils, proteins, and the total amount of oils in 2 g of leaves of Elaeagnus macrophylla Thunb., was 2.635%, equal to It is known that total carbohydrates are 0.168 g in 1 g of leaf.

References

1. A.L. Budansev, Y.Y. Lesiovskaya, Dikorastushiye polezniye rasteniya Rossii, SPXFA, SPb., 663 (2001)
2. A.Ya. Gubergris, A.Ya. Solomchenko, Medicinal plants of Donbass – Donesk, “Donbass”, 296 (1967)
3. N. Aziza, K. Khaydarov, D. Zamira, U. Ochilov, M. Dilshod, Exploring microscopic pollen morphology in herbaceous Flora: Insights and analysis using scanning electron microscopy, Microscopy Research and Technique, 1–9 (2024) https://doi.org/10.1002/jemt.24508
4. D.B. Dekhkonov, Kh.K. Khaydarov, B.E. Kadirov, K.Sh. Tojibaev, Morphology and distribution patterns of Tulipa fosteriana and Tulipa ingens, Plant Science Today, **10**, **2**, 426–438 (2003)
5. Zamira Djumayeva, Khaydarov Khislat, Zafar Muhammad, Fawzy Mohamed Ramadan, Ahmad Mushtaq, Aziza Nozimova, Ochilov Ulugbek, Zebiniso Umurzakova, Farzona Davronkulova, Comprehensive study of allergenic tree species: Palynological insights enhanced by HPLC and GC-MS profiling. Biomed Chromatogr. Feb; **38**, **2**, e5774 (2024)
6. M.I. Goryayev, Metodi issledovaniya efirnix masel, Alma- Ata, Izd-vo AN Kaz. SSR,. 739 (1962)
7. Gosudarstvennaya farmakopeya SSSR: Vip. 1. Obshiye metodi analiza MZ SSSR, 11-ye izd., dop., M. Meditsina, 334 (1987)
8. Z. Jumayeva, N. Nurullayeva, A. Nozimova, X. Tursunboev, G. Dosjanova, Dynamics and characteristics of allergenic plant pollen in the Republic of Uzbekistan, E3S Web of Conferences, **498**, 02015 (2024)
9. M. Manzoor, M. Ahmad, M. Zafar, S. Waseem Gillani, H. Shaheen, A. Pieroni, A. Ahmed Al-Ghamdi, M. Soliman Elshikh, S. Saqib, T. Makhkamov, Kh. Khaydarov, Correction to: The local medicinal plant knowledge in Kashmir Western Himalaya: a way to foster ecological transition via community-centred health seeking strategies. Journal of Ethnobiology and Ethnomedicine, **19**, **1**, **56** (2024) doi: 10.1186/s13002-023-00631-2
10. Maria Ameen, Muhammad Zafar, Mushtaq Ahmad, Mamoona Munir, Islem Abid, Abd El-Zaher M A Mustafa, Mohammad Athar, Trobjon Makhkamov, Oybek Mamarakhimov, Akramjon Yuldashev, Khislat Khaydarov, Afat O Mammadova, Laziza Botirova, Zokirjon Makkamov, Cleaner Biofuel Production via Process

Parametric Optimization of Nonedible Feedstock in a Membrane Reactor Using a Titania-Based Heterogeneous Nanocatalyst: An Aid to Sustainable Energy Development. Membranes (Basel), **13**, **12**, 889 (2023) doi: 0.3390/membranes13120889

11. Maroof Ali, Saraj Bahadur, Abrar Hussain, Sara Saeed, Izaz Khuram, Manzoor Ullah, Jian-Wen Shao, Naveed Akhtar, Foliar epidermal micromorphology and its taxonomic significance in Polygonatum (Asparagaceae) using scanning electron microscop. Microsc Res Tech., **83**, **11**, 1381-1390 (2020) doi: 10.1002/jemt.23529
12. G. Matkarimova, N. Nurullayeva, K. Khaydarov, Chemical composition of the fruits of Cornus mas L. introduced in Uzbekistan, E3S Web of Conferences, **462**, 02010 (2023)
13. Muhammad Manzoor, Mushtaq Ahmad, Muhammad Zafar, Syed Waseem Gillani, Hamayun Shaheen, Andrea Pieroni, Abdullah Ahmed Al-Ghamdi, Mohamed Soliman Elshikh, Saddam Saqib, Trobjon Makhkamov, Khislat Khaydarov, The local medicinal plant knowledge in Kashmir Western Himalaya: a way to foster ecological transition via community-centred health seeking strategies. J Ethnobiol Ethnomed, **19**, **1**, 56 (2023) doi: 10.1186/s13002-023-00631-2
14. D.A. Muravyeva, Farmakognoziya (Meditsina, Moscow, 1991)
15. A. Nozimova, Kh. Khaydarov, M. Zafar, Waleed A A Alsakkaf, J. Alkahtani, M. Ahmad, T. Makhkamov, Z. Djumayeva, G. Zengin, Kh. E. Tursunboev, A. Beilerli, I. Gareev, U. Ochilov, B.S. Islamov, Z.I. Umurzakova, Putu Agus Hendra Wibawa. Chromatographic authentication of botanical origin: Herbaceous pollen profiling with HPLC, HPTLC and GC-MS analysis. Biomed Chromatogr, e5852 (2024) doi: 10.1002/bmc.5852
16. N. Nurullayeva, K. Haydarov, Z. Umurzakova, D. Safarova, Growth and development of Lycium barbarum L. in the environment of Samarkand in Uzbekistan, Plant Science Today, **8**, **2**, 278–282 (2021)
17. R.R. Rakhmonov, A.R. Rayimov, Ecological positions of hunting species in Bukhara region. International Journal of Genetic Engineering, **7**, **1**, 15-18 (2019)
18. A.R. Rayimov, R.R. Rakhmonov, The distribution and number of Acridotherestristis in different habitats in the Kyzylkum. Nature of inner asia, **2**, **11**, 60-64 (2019)
19. A.R. Rayimov, R.R. Rakhmonov, The role of Acridotheres Tristis in Biotic Connection. International Journal of Virology and Molecular Biology, **8**, **1**, 1-3 (2019)
20. Shaista Jabeen, Muhammad Zafar, Mushtaq Ahmad, M Ajmal Ali, Mohamed S Elshikh, Trobjon Makhkamov, Oybek Mamarakhimov, Akramjon Yuldashev, Khislat Khaydarov, Yusufjon Gafforov, Babir Baysunov, Afat O Mammadova, Laziza Botirova, Shazia Sultana, Salman Majeed, Rozina, Shabir Ahmad, Aqsa Abid, Abdurashid Rahmatov, Micrometer insights into Nepeta genus: Pollen micromorphology unveiled. Micron, **177**, 103574 (2024)
21. S.V. Sur, Metodi videleniya, identifikatsii i opredeleniya terpenovix soyedineniy S.V. Sur. Rast. resursi, **26**, **1**, 42-50 (1990)
22. I.I. Sidorov, Texnologiya naturalnix efirnix masel i sinteticheskix dushistix veshyestv, M. Legkaya i pish. promst, 368 (1984)
23. D.G. Zyukov, Ye.N. Andreyevich, A.P. Chipiga, Texnologiya i oborudovaniye efirnomaslichnogo proizvodstva, M. Pish. prom-st., 190 (1979)