UDC 664.022.3-035.66:665.52:633.812

ESSENTIAL OIL OF *LAVANDULA ANGUSTIFOLIA MILL.* OF LIDIIAVARIETY AS A SOURCE OF AROMATIC COMPOUNDS FOR THE FOOD INDUSTRY

L. Svydenko[1], Candidate of Biological Sciences, Senior Researcher
N. Valentiuk[2], Candidate of Technical Sciences, Senior Researcher
G. Stankevych[3], Doctor of Technical Sciences, Professor
Ye.Yurkevych[4]**,** Doctor of Agricultural Sciences, Professor
A. Svydenko[5], Candidate of Economic Sciences
N. Martiyenko[1], Junior Research Fellow
O. Vergun[6]**,** Candidate of Biological Sciences, Senior Researcher
O. Grygorieva[6] Candidate of Biological Sciences, Senior Researcher
[1] Department of Introduction and Breeding of Rare Fruit, Ornamental and Aromatic Plants
[2] Department of Primary and Elite Seed Production
[5] Department of Geoinformation Technologies, Management and Economic Research
Institute of Climate Smart Agriculture of the National Academy of Agrarian Sciences of Ukraine,
24 Mayatska Doroga St., Khlibodarske village, Odesa Region, 67667
[3] Department of Grain and Feed Technology
Odesa National University of Technology, 112 Kanatna St., Odesa, Ukraine, 65039
[4] Department of Field and Vegetable Crops
Odesa State Agrarian University, 99 Kanatna St., Odesa, Ukraine, 65039
[6] National Botanical Garden named after M.M. Hryshka of the National Academyof Sciences, 1 Sadovo-Botanichna St., Kyiv, 01014

https://doi.org/ 10.15673/fst.v18i4.3143

Correspondence:

G. Stankevych
E-mail: georgii.stn@gmail.com

Cite as Vancouver style citation

Svydenko L, Valentiuk N, Stankevych G, Yurkevych Ye. et al. Essential oil of Lavandula angustifolia mill. of Lidiia variety as a source of aromatic compounds for the food industry. Food science and technology. 2024;18(4):56-62. https://doi.org/ 10.15673/fst.v18i4.3143

Цитування згідно ДСТУ 8302:2015

Essential oil of Lavandula angustifolia mill. of Lidiia variety as a source of aromatic compounds for the food industry / Svydenko L. // Food science and technology. 2024. Vol. 18, Issue 4. P. 56-62. https://doi.org/10.15673/fst.v18i4.3143

Abstract. Every year, more and more consumers have a negative attitude towards food products that contain synthetic additives. Therefore, the production of natural flavors from essential oils of plants is an important task today. Lavender essential oil is a promising raw material for the food industry and the selection of varieties with a high content of essential oil and high indicators of valuable components in it is relevant. The material for the research was lavender plants (*Lavandula angustifolia Mill*.) of the Lidiia variety, which were introduced in the Odessa region conditions. The study of the essential oil mass fraction was carried out by the Ginsberg method on the Clevenger apparatus in the flowering phase of plants and was calculated on the dry mass of plant raw materials. The study of the component composition of essential oil was carried out by the method of high-performance gas-liquid chromatography by chromatograph Agilent Technology 6890N. Under the introduction conditions, the plants grew and developed normally. It was found that the yield of floral raw materials of three-year-old plants in the flowering phase ranged from 170 to 240 g per shrub. In the mass flowering phase, the yield of floral raw materials was maximum. The mass fraction of essential oil in inflorescences varied from 0.9 to 1.2% of the fresh mass or from 2.16 to 2.94% of the absolutely dry mass. The highest content of essential oil was recorded in the end-of-flowering phase. The study of the component composition of essential oil made it possible to identify 30 compounds. It was found that the essential oil of lavender of the Lidiia variety contains a large mass fraction of the valuable component linalyl acetate, the indicators of which vary in a small range depending on the flowering phase. Its highest content (48.11%) was found in the mass flowering phase and the lowest one (43.12%) was founf in the phase of the beginning of flowering. The content of linalool, on the contrary, was the highest (26.07%) in the phase of the beginning of flowering, and in the phase of mass flowering it decreased to 23.08%. The content of undesirable components of camphor and 1,8-cineole in the essential oil is low. The minimum content of these components was observed in the phase of mass flowering. According to its component, the essential oil of lavender of the Lidiia variety is of high quality, and will use in various sectors of the national economy, including the food industry.

Keywords: *Lavandula angustifolia Mill.*, Lidiia variety, essential oil components, analysis of variance, food products.

Introduction. Formulation of the problem

Our daily diet includes a large number of pigments, especially carotenoids, anthocyanins and chlorophylls. These compounds have important biological functions in the human body against many serious diseases. Therefore, the use of plant extracts as functional ingredients in various food products, beverages and cosmetic purposes is gaining more and more interest [1-3]. Today, more and more consumers react negatively to synthetic additives, looking for organic products, even with their higher cost.All over the world, the number of companies unwilling to use antibiotics or chemical compounds in food production is increasing. The population demands products that do not contain artificial and harmful chemicals used as preservatives. Another major problem is the incorrect use of antibiotics, especially broad-spectrum antibiotics, which significantly contributes to the increase in antibiotic resistance of many microorganisms.Therefore, the entire scientific world has recently focused numerous studies on the search for natural remedies capable of counteracting pathogens of food origin. One of these means is the essential oils of aromatic plants. Therefore, the production of natural flavorings should become part of the state program of naturalization of domestic food products [4-7].

Flavorings with spicy, citrus, caramel smells are recognized as priority aromas for food manufacturers. However, recently manufacturers are interested in natural carriers of fruit aroma. Various floral aromas, such as rose, jasmine, and lavender, which were previously used in the perfume industry, also find their purpose in soft drinks and alcoholic beverages productions [8]. Lavender occupies one of the leading places among aromatic plants.Interest in lavender is due to its wide range of uses in the perfume industry (soap, colognes, perfumes, skin lotions and other cosmetics), in aromatherapy (relaxant), and in pharmaceuticals due to its therapeutic effects as a sedative, antispasmodic, antiviral and antibacterial agent [2,5].

The widespread use of lavender essential oil in traditional medicine and the pharmaceutical industry has led to an increased interest in it in other fields. The use of lavender essential oil in the food industry has increased due to its pleasant aroma and taste, as well as its ability to control the growth of infectious agents [9].

Lavender essential oil and its hydrolats are currently widely used in food production as natural flavors for bakery products, frozen dairy products, candies, gelatin, puddings, soft and alcoholic drinks, ice cream, chewing gum. In the UK, Norfolk Lavender booklets offer many recipes for cooking with lavender at home, such as herring or trout stuffed with lavender sprigs [10].

The distribution of domestically produced flavorings is complicated by a number of factors, primarily the dominance of imported products in the raw materials market, as well as the high costrisks that may accompany the production of domestic flavorings. The orientation of Ukrainian producers to cooperation with domestic science and the essential oil complex of Ukraine will contribute to the solution of these problems [8].

Analysis of recent research and publications

The *Lavandula*genusincludes 39 species, more than 400 varieties and several hybrids. Species of the genus Lavender are among the most cultivated plants in the world. This plant is especially popular in France, Bulgaria, Italy, Spain, England, the USA and Australia. Lavender species are widely used as ornamental and honey plants but, mainly, they are grown to obtain essential oils, which are highly valued in perfumery, cosmetics, food industry and alternative medicine [10-15].

According to scientists, among all the existing lavender species, only three species (*Lavandula angustifolia Mill.*, *Lavandula x intermedia Emeric ex Loisel*and*Lavandula latifolia Medicus*) are cultivated for essential oil production. The commercial value of these species is estimated at $50 million in the pharmaceutical, food, and cosmetic industries [3,13,16].

Romanian scientists, developing natural ingredients with diverse biological functions that would provide potential benefits for human health, added lavender powder to macaroons and ice cream. As a result of their research, they concluded that lavender, with its high flavor, antimicrobial and antioxidant properties, could become a valuable ingredient in food products [2].

It is known that the quality of lavender essential oil depends on its composition [5,17]. Many scientists from Romania, Turkey, Croatia, Ukraine and other countries have studied the component composition of lavender essential oil [3,6]. Scientists from different countries have proven that the chemical composition of lavender essential oils and lavandin is characterized by the presence of terpenes (e.g., linalool and linalyl acetate) and terpenoids (e.g., 1,8-cineole), which are mainly responsible for the characteristic taste, as well as biological and therapeutic properties. [2,11,17,18]. The high content of linalool and linalyl acetate determines the high quality of the essential oil [19-22].

Italian scientists, studying the component composition of lavender essential oil and lavandin, noted the variability of the content of various compounds in the oil depending on the vegetation phase [6]. Scientific works of domestic scientists also indicate the variability of the mass fraction of essential oil and its component composition in plants depending on the variety, development phase and growing conditions [13-16,23].

According to literature data, essential oil in lavender plants is contained in all organs of the plant, but its greatest amount is concentrated in inflorescences. In addition, compared to other organs, essential oil from inflorescences has the best component composition [24].

At the Institute of Climatic Smart Agriculture on the basis of the State Enterprise "Research Farm "Novokakhovske" of the Institute of Climatic Smart Agriculture of the NAAS, *Lavandula angustifolia Mill.* varieties for various uses have been created in different years. The created varieties have been introduced into the conditions of the Odesa region.

The purpose and objectives of the study. The purpose was to study the content of essential oil and its component composition by the development phases of *Lavandula angustifolia Mill.*of the Lidiia variety for cultivation and the possibility of its use in the food industry.

The objectives of the study were to determine by the development phases of *Lavandula angustifolia Mill.* of the Lidiia variety:

1) yield of floral raw materials;

2) content and dynamics of accumulation of the mass fraction of essential oil;

3) component composition of essential oil and dynamics of its accumulation.

Research materials and methods

The research was conducted in the southern steppe zone in the conditions of the Odessa region in the village of Okny, Podolsk district. The territory of the district is located in the northern part of the Black Sea lowland. The soils are thick medium-humus black soils on loess rocks.

The most important indicators of climatic conditions:

- sum of active temperatures (above 10°C) was 29.05°C;
- annual relative humidity was 75%;
- moisture supply (precipitation) per year was 490 mm;
- moisture supply during the growing season was 343 mm;
- period with a temperature above 10 °C was 169 days;
- average annual air temperature was +8.1 °C;
- average temperature of the warmest month (July) was +20.5 °C;
- calendar dates of frost: the last wasin April, the first was in October;
- dominant wind direction: in the spring and summer period it was westerly, throughout the year it was westerly.

The material for the research was *Lavandula angustifolia Mill.*plantsof the Lidiia variety. In the flowering phase, the inflorescences together with the peduncles (12–15 cm long) were cut and immediately weighed. Fresh flower raw materials (100 g) were placed in a liter flask and filled with water. The study of the mass fraction of essential oil was carried out by the Ginsberg method on the Clevenger apparatus and was calculated on the dry mass of plant raw materials [18,19].

The study of the component composition of the essential oil was carried out by high-performance gas-liquid chromatography [11,18,21] on an Agilent Technology 6890N chromatograph. The chromatographic column was quartz, capillary HP 5MS. The evaporator temperature was 250°C. The carrier gas was helium. The carrier gas flow rate was 1 ml/min. Sample introduction with a flow split of 1/50. The thermos temperature was 50°C with a programming of 3 °/min to 220°C. The detector and evaporator temperatures were 250°C. The components of the essential oils were identified based on the results of searching for mass spectra of chemicals included in the studied mixtures obtained during chromatography with data from the NIST02 mass spectra library (over 174,000 substances). The component retention indices were calculated based on the results of control analyses of essential oils with a set of normal alkanes [11,18,21].

The experiments were conducted in 4-fold replication according to a single-factorial design using randomized blocks, which eliminates the subjective approach to the placement of variants and provides more objective research results. The results were processed using variance analysis. The statistical reliability of the obtained experimental data was assessed by the least significant differences (LSD_{05}) for a significance level of 0.05.

Results of the research and their discussion

Lavandula angustifolia Mill. plantsof the Lidiia varietywere introduced to the Odesa region in 2022 from the State Enterprise "Research Farm "Novokakhovske" of the Institute of Climatic Smart Agriculture of the NAAS. One-year-old seedlings were planted in the spring in collection plots. Phenological observations conducted on the introducers showed that the vegetation of plants of the second year of life in the conditions of the Odessa region begins in the II decade of April, the budding phase occurs in the I–II decade of May, the ring spreading phase occurs in the I decade of June. After a decade, we note the colored bud phase. The beginning of flowering occurs in the II decade of June, and mass flowering is noted in the III decade of June – the I decade of July. Fruiting lasts from the II decade of July to the III decade of August.

Under introductionconditions, on the third year of life, the shrubs reach medium size and have a compact shape [13,14,24]. Of course, the biometric characteristics of plants and their yield, depend on many factors, including the variety, the presence of the optimal amount of precipitation, the temperature regime, the applied agrotechnical measures, etc. [25-27]. In addition, the growing conditions also affect the quality of the oil obtained and the possibility of its use in various sectors of the national economy [5,17,25-30].

Under growing conditions in the Odesa region, *Lavandula angustifolia Mill.* shrubs of the Lidiia variety were 60 cm high and 65 cm in diameter. Flowering shoots were straight, green, medium thickness, 28–30 cm long. There were 75–95 inflorescences on the plant. The inflorescence was dense, 7–8 cm long. The number of rings in the inflorescence was 8–10 pcs. The number of flowers in the middle ringwas 14–16 pcs. The number of flowers in the inflorescence was 80 pcs. The calyx of the corolla was green. The corollas of the flower were large, purple in color, moderately pubescent. The leaves were gray-green, large, 5.0–5.5 cm long (on average 5.2 cm), 0.6–0.8 cm wide (on average 0.7 cm), heavily pubescent.

According to the results of the research, the yield of flower raw materials on the third year of the seedlings' life was 170–240 g per plant. In the phase of the beginning of flowering it was the smallest, and in the phase of the end of flowering it was the maximum (Table 1).

The study of the essential oil accumulation dynamicsin the inflorescences of the Lidiia variety of lavender in different phases of plant development showed that its mass fraction gradually increases starting from the phase of the end of budding – the beginning of flowering. The maximum indicators of the content of essential oil in the inflorescences were recorded in the phase of the end of flowering (Table 1).

During the study of the component composition of the essential oil, 30 compounds were identified. According to the data obtained in research, it is clear that the essential oil of the Lidiia variety of lavender was of high quality in terms of its component composition. The main components of this lavendervariety essential oil were linalyl acetate and linalool. Compared to other domestic varieties, this variety had the highest levels of linalyl acetate [13,14,16]. Studying the dynamics of the main components content in the essential oil depending on the phase of development, it was established that the mass fraction of the components changed in one direction or another (Table 2).

As an analysisresult of the essential oilcomponent composition, it was found that the content of the valuable component, linalyl acetate, in the phase of the beginning of flowering was 43.12% of the mixture. As the plants developed, plant biosynthesis increased by 4.99%, reached a maximum (48.11%of the mixture) in the phase of mass flowering. In the phase of the end of flowering, it was noted a decrease in the mass fraction of linalyl acetate by 2.51%.

As for another valuable component, linalool, its content in the phase of the beginning of flowering was maximum (26.07% of the mixture). In the phase of mass flowering, the content of linalool decreased by 2.99% and was 23.08%of the mixture. In the process of further plant development, the biosynthesis of this component gradually increased, reached 25.62% of the mixture in the phase of the end of flowering, which was per 2.54% more than in the phase of mass flowering.

As is known, a significant negative impact on the quality of lavender essential oil has a camphor. Although its amount is not significant,but it is not desirable. In the process of plant development, its content decreased by 0.12% compared to the beginning of flowering phase, where it was 0.38%, and in the mass flowering phase it was minimal (0.26%). In the end of flowering, an increase in camphor by 0.15% was observed.

Another undesirable component of lavender essential oil is 1,8-cineole, which was practically absent in the beginning and mass flowering phases and was present only in a small amount in the end of flowering.

Approbation of research results. The research was conducted in a farm located in the Oknyvillage, Podilskyi district, Odesa region, Ukraine.

Table 1 – Economically valuable indicators of *Lavandula angustifolia Mill.* of Lidiia variety by development phases (p=0.05)

Phaseof plant development	Yield of flower raw materials, g /plant	Mass fraction of essential oil,%	
		of crude mass of flower raw materials	of absolutely dry mass of flower raw materials
Endof budding – beginning of flowering	170±19	0.90±0,01	2.16±0,02
Mass flowering	240±36	1.12±0,01	2.78±0,02
Endof flowering	200±28	1.20±0,01	2.94±0,02
LSD_{05}	46.926	0.014	0.028

LSD_{05} – least significant difference for the 5% significance level

Table 2 – Dynamics of accumulation of components of essential oil of *Lavandula angustifolia Mill.*of Lidiia by development phases

Components	Content in essential oil by flowering phases, %		
	beginning	mass	end
α-pinene	–	0.16	–
1-octen-3-ol	0.08	–	0.63
myrcene	0.12	0.11	0.28
Δ3-carene	–	–	0.19
cymene	–	–	0.50
1,8-cineole	–	–	0.51
γ-terpinene	0.05	–	0.96
octanone-3	–	0.57	–
hexyl acetate	–	0.38	–
trans-linalool oxide	1.4	0.92	0.80
cis-linalool oxide	1.1	0.82	0.74
linalool	26.07	23.08	25.62
3-octenyl acetate	–	1.02	1.32
camphor	0.38	0.26	0.41
borneol	1.85	0.74	0.99
lavandulol	0.78	0.29	–
terpinen-4-ol	1.52	1.76	1.03
α-terpineol	3.90	3.28	4.10
3,7-dimethyl-1,5-octadiene-3,7-diol	2.10	0.66	–
neral	–	0.44	–
linalyl acetate	43.12	48.11	45.60
bornyl acetate	–	0.51	0.55
lavandulyl acetate	3.0	3.38	5.26
neryl acetate	1.9	1.08	1.41
geranyl acetate	1.7	2.02	2.59
germacrene D	–	–	0.99

Conclusions

According to the researchresults, it was established that the yield of floral raw materials in the third year of life of *Lavandula angustifolia Mill.* seedlings of the Lidiia variety, grown in the conditions of the Southern Steppe in 2022, was 170–240 g per plant. In the phase of the beginning of flowering, it was the smallest, and in the phase of the end of flowering, it was the maximum. It was also established that lavender contained a satisfactory amount of essential oil, the content of which ranged from 0.9 to 1.2% of the fresh mass, or from 2.16 to 2.94% of the absolutely dry mass. The maximum indicators of essential oil biosynthesis were noted in the phase of the end of flowering.

Determination of the essential oil composition and the dynamics of the mass fraction accumulation of its main components showed that the quality of the essential oil was best in the mass flowering phase, since the mass fraction of its most valuable component, linalyl acetate, was highest in this phase and was 48.11% of the mixture. Taking this into account, the collection of floral raw materials for obtaining essential oil is recommended to be carried out in the mass flowering phase.

The high content of linalyl acetate gives the plant a pleasant aroma. In terms of its component composition, the essential oil of the Lidiia variety of lavender was of high quality, and plants of this variety are promising for cultivation for use in various sectors of the national economy, including the food industry for the production and improvement of the quality of various food products such as natural flavorings for bakery products, frozen dairy products, candies, gelatin, puddings, tea, soft and alcoholic drinks, ice cream, seasonings for herring or trout, etc.

References:

1. Radu (Lupoe) DS, Rapeanu G, Bahrim GE, Stanchuk N. Investigations on thermal degradation of phytochemicals from lavender extract. Anna. Univ. Dunarea Jos Galati Fascicle VI – Food Technol. 2019;43:33-47. https://doi.org/10.35219/foodtechnology.2019.2.03
2. Radu SD, MihalceaL, AproduIu, Socaci SA, Cotârleț M, Enachi E, Crăciunescu O, Barbu V, Oancea A, Dulf Francisc V, Alexe P, Bahrim GE. Fostering Lavender as a Source for Valuable Bioactives for Food and Pharmaceutical Applications through Extraction and Microencapsulation. J. Molecules 2020;25(21):5001. https://doi.org/10.3390/molecules25215001
3. Giray FH. An Analysis ofWorld Lavender Oil Markets and Lessons for Turkey. J. Essent. Oil Bear. Plants 2018;21:1612-1623. https://doi.org/10.1080/0972060X.2019.1574612

4. Héral B, Stierlin, É, Fernandez X, MichelT. Phytochemicals from the genus Lavandula: A review. Phytochem. Rev. 2021;20:751-771. https://doi.org/10.1007/s11101-020-09719-z
5. DétárE, Zámbori-Németh É, Gosztola B, Harmath A, LadányiM, PluhárZ. Ontogenesis and harvest time are crucial for high quality lavender – Role of the flower development in essential oil properties. Ind. Crops Prod. 2021;163:113-334. https://doi.org/10.1016/j.indcrop.2021.113334
6. Speranza B, Guerrieri A, Racioppo A, Bevilacqua A, Campaniello D, Rosaria M.Corbo sage and lavender essential oils as potential antimicrobial agents for foods. J. Microbiol. Res. 2023;14(3):1089-1113. https://doi.org/10.3390/microbiolres14030073
7. Frolova N, Ukrainets A, Sylka I, Naumenko K, Chepel N. Actuality and ways of processing local spicyaromatic raw materials into food flavors. Scientific Works of NUFT 2017; 23(5):220-228. https://doi.org/110.24263/2225-2924-2017-23-5-2-28
8. Ukrainets A, Frolova N. The analytical information about status of flavors usage in the world and in Ukraine and possibilities of domestic production development. Scientific Works of NUFT 2019;25(2):251-260 https://doi.org/10.24263/2225-2924-2019-25-2-27
9. Lauren A. Erland, SoheilS. Mahmoud. Essential Oils in Food Preservation, Flavor and Safety.Lavender (Lavandula angustifolia) Oils. 2016;57:501-508. http://dx.doi.org/10.1016/B978-0-12-416641-7.00057-2
10. Lis-Balchin MT. Handbook of herbs and spices. Woodhead Publishing Series in Food Science, Technology and Nutrition.Lavender. 2012; 2(17):329-347. https://doi.org/10.1533/9780857095688.329
11. JianuC, PopG, GruiaAT, GeorgeHF. Chemical composition and antimicrobial activity of essential oils of lavender (Lavandula angustifolia) and lavandin (lavandula x intermedia) grown in Western Romania. Int. J. of Agriculture & Biology ISSN Print: 1560–8530; ISSN Online: 1814–9596 12–1270/2013/15–4–772–776
12. Aprotosoaie AC, GilleE, Trifan A, Luca VS, Miron A. Essential oils of Lavandula genus: A systematic review of their chemistry. Phytochem. Rev. 2017;16;761-799. https://doi.org/10.1007/s11101-017-9517-1
13. Svydenko LV, HlushchenkoLA, SvyrydovskyyVM, SvydenkoAV. Lavandin: a practical guide. Odesa: Oldi+. 2023:44p. ISBN 978-966-289-725-8 (in Ukrainian)
14. Svydenko LV, Hlushchenko LA, Verhun OM, Korablʹova OA. Lavandula L. Collection of the Institute for Climate Smart Agriculture. Plant genetic resources. 2023;32:58-69. https://doi.org/10.36814/pgr.2023.32.07 (in Ukrainian)
15. Beale DJ, Morrison PD, Karpe AV, Dunn MS. Chemometric Analysis of Lavender Essential Oils Using Targeted and Untargeted GC-MS Acquired Data for the Rapid Identification and Characterization of Oil Quality. Molecules. 2017; 22(8):1339. https://doi.org/10.3390/molecules22081339
16. Rabotyahov VD, Svydenko LV. Creating highly productive forms of lavender through interspecific crosses. Methodological recommendations. Nikitsky Botanical Garden. Yalta, 2010:36. (in Ukrainian)
17. Détár, E.; Németh, É.Z.; Gosztola, B.; Demján, I.; Pluhár, Z. Effects of variety and growth year on the essential oil properties of lavender (Lavandula angustifolia Mill.) and lavandin (Lavandula x intermedia Emeric ex Loisel.). Biochem. Syst. Ecol. 2020;90:104020. https://doi.org/10.1016/j.bse.2020.104020
18. Pokajewicz K, Białoń M, Svydenko L, Hudz N, Balwierz R, Marciniak D, Wieczorek PP. Comparative Evaluation of the Essential Oil of the New Ukrainian Lavandula angustifolia and Lavandula x intermedia Cultivars Grown on the Same Plots. Molecules. 2022; 27(7):2152. https://doi.org/10.3390/molecules27072152
19. Jennings W, Shibamoto T. Qualitative Analysis of Flavor and Fragrance Volatiles by Glass Capillary Gas Chromatography. Academic Press rapid Manuscript Reproduction. 1980:472. ISBN978-0123842503
20. Truzzi E, Benvenuti S, Bertelli D, Francia E, Ronga D. Effects of Biostimulants on the Chemical Composition of Essential Oil and Hydrosol of Lavandin (*Lavandula x intermedia* Emeric ex Loisel.) Cultivated in Tuscan-Emilian Apennines. Molecules. 2021;26(20):6157. https://doi.org/10.3390/molecules26206157
21. Popa CL, Lupitu A, Mot MD, Copolovici L, Moisa C, Copolovici DM. Chemical and biochemical characterization of essential oils and their corresponding hydrolats from six species of the Lamiaceae family. Plants 2021;10:2489. https://doi.org/10.3390/plants10112489
22. Radu Lupoae D, Alexe P, Stănciuc N. Overview on the potential role of phytochemicals from lavender as functional ingredients. The Annals of the University Dunarea de Jos of Galati Fascicle VI-Food Technology. 2020;44(2):173-188. https://doi.org/10.35219/foodtechnology.2020.2.11.
23. Dobrowolska A, Zawadzińska A. The Influence of Stratification on Seedling Emergence and Growth of Narrow-Leaved Lavender and its Cultivars. Int. J. of Plant & Soil Science 2014;3(8):948-958 https://doi.org/10.9734/IJPSS/2014/9861
24. Mihalașcu C, Bolohan C, Tudor V, Mihalache M, Teodorescu R. Research on the growth and development of some varieties of Lavandula angustifolia (Mill.) in the South-East of Romania / Romanian biotechnological letters. 25(6):2180-2187. https://doi.org/10.25083/rbl/25.6/2180.2187.
25. MicleaI, Chifor R. Germination, in vitro Propagation and Acclimatization in Lavandula Angustifolia. Bulletin UASVM Animal Science and Biotechnologies. 2018;75(2):105. https://doi.org/10.15835/buasvmcn-asb:2018.0017
26. Hasibi A, Abdossi V, Ladanmoghadam A, Moradi P. Variation of some traits of *Lavandula angustifolia* to drought stress for optimum water usage. *European journal of horticultural science*. 2022;87(4). https://doi.org/10.17660/ejhs.2022/041
27. Tardugno R, Serio A, Pellati F, D'Amato S, Chaves López C, Bellardi MG, Di Vito M,Szekely-Varga Z, Kentelky E, Cantor M. Effect of gibberellic acid on the seed germination of Lavandula angustifolia Mill. Romanian journal of Horticulture. 2021;2(2):169-176. https://doi.org/10.51258/rjh.2021.22.
28. Roberts SJ, Parkinson NM. A bacterial leaf spot and shoot blight of lavender caused by Xanthomonas hortorumin the UK. New disease reports. 2014;30:1. https://doi.org/10.5197/j.2044-0588.2014.030.001
29. Zhelyazkov I, Delibaltova V, Krastev T. Study on the efficacy of some herbicides for weed controlling in lavender field. *Research journal of agricultural science*. 2018; 50(1):178-185.
30. Białon M, Krzysko-Łupicka T, Nowakowska-Bogdan E, Wieczorek PP. Chemical Composition of Two Different Lavender Essential Oils and Their Effect on Facial Skin Microbiota. Molecules 2019;24:3270. https://doi.org/10.3390/molecules24183270

ЕФІРНА ОЛІЯ *LAVANDULA ANGUSTIFOLIA MILL.* СОРТУ ЛІДІЯ ЯК ДЖЕРЕЛО АРОМАТИЧНИХ СПОЛУК ДЛЯ ХАРЧОВОЇ ПРОМИСЛОВОСТІ

Л.В. Свиденко[1]**,** кандидат біологічних наук, старший науковий співробітник, *E-mail*: svid65@ukr.net
Н.О. Валентюк[2]**,** кандидат технічних наук, старший науковий співробітник, *E-mail*: naval100@ukr.net
Г.М.Станкевич[3]**,** доктор технічних наук, професор, *E-mail*: georgii.stn@gmail.com
Є.О. Юркевич[4], доктор сільськогосподарських наук, професор, *E-mail*:yevgen21@ukr.net
А.В. Свиденко[5]**,** кандидат економічних наук, *E-mail*: zulu_jp4@ukr.net
Н.С.Мартієнко[1], молодший науковий співробітник,
О.М.Вергун[6]**,** кандидат біологічних наук,старший науковий співробітник, *E-mail*: olenavergun8003@gmail.com
О.В.Григор'єва[6]**,** кандидат біологічних наук,старший науковий співробітник, *E-mail*: olgrygorieva@gmail.com
[1]Відділ інтродукції та селекції малопоширених плодових, декоративних та ароматичних рослин
[2]Відділ первинного та елітного насінництва
[5]Відділ геоінформаційних технологій, менеджменту та економічних досліджень
Інститут кліматично орієнтованого сільського господарства НААН України,
вул. Маяцька дорога, 24, смт Хлібодарське, Одеська область, 67667,
[3]Кафедра технології зерна і комбікормів
Одеський національний технологічний університет, вул. Канатна, 112, м. Одеса, Україна, 65039
[4]Кафедра польових і овочевих культур
Одеський державний аграрний університет, вул. Канатна, 99, м. Одеса, Україна, 65039
[6]Національний ботанічний сад ім. М.М. Гришка НАН України, вул. Садово-Ботанічна, 1, Київ, 01014

Анотація. З кожним роком все більше споживачів негативно ставляться до продуктів харчування, які містять синтетичні добавки. Тому виробництво натуральних ароматизаторів із ефірних олій рослин на сьогодні є важливим завданням. Ефірна олія лаванди вузьколистої слугує перспективною сировиною для харчової промисловості і підбір сортів із великим вмістом ефірної олії та високими показниками цінних компонентів в ній є актуальним. Матеріалом длядосліджень слугували рослини лаванди вузьколистої сорту Лідія, які були інтродуковані в умовах Одеської області. Вивчення масової частки ефірної олії проводили методом Гінсберга на апараті Клєвенжера у фазі цвітіння рослин і розраховували на суху масу рослинної сировини. Вивчення компонентного складу ефірної олії проводили методом високоефективної газорідинної хроматографії на хроматографі Agilent Technology 6890N. В умовах інтродукції рослини нормально росли і розвивались. Встановлено, що у рослин трьохрічного віку у фазі цвітіння урожай квіткової сировини коливався від 170 до 240 г з куща. У фазі масового цвітіння він був максимальним. Масова частка ефірної олії в суцвіттях варіювала від 0,9 до 1,2% від сирої маси або від 2,16 до 2,94% від абсолютно сухої маси. Найбільший вміст ефірної олії зафіксовано у фазі кінця цвітіння. Вивченнякомпонентногоскладуефірноїоліїдаломожливістьідентифікувати 30 сполук. Встановлено, що в ефірній олії лаванди сорту Лідія є велика масова частка цінного компоненту – ліналілацетату, показники якої змінюються в невеликому діапазоні в залежності від фази цвітіння. Найбільший його вміст виявлено у фазі масового цвітіння – 48,11%, а найменший у фазі початку цвітіння – 43,12%. Вміст ліналоолу навпаки най більший у фазі початку цвітіння і становить 26,07%, а у фазі масового цвітіння зменшується до 23,08%. Вміст небажаних компонентів камфори та 1,8-цинеолу в ефірній олії невисокий. Мінімальний вміст цих компонентів спостерігається у фазі масового цвітіння. За своїм компонентним складом ефірна олія лаванди сорту Лідія є високоякісною і може використовуватися в різних галузях народного господарства, в тому числі і харчової промисловості.

Ключові слова: лаванда вузьколиста, сорт Лідія, компоненти ефірної олії, дисперсійний аналіз, продукти харчування.