

ESSENTIAL OIL-BEARING AND MEDICAL PLANTS

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**SOME ESSENTIAL ELEMENTS CONTAINED IN RAW MATERIALS OF
LAVANDIN (*LAVANDULA HYBRIDA* REVERCHON) - NIKITSKY BOTANICAL
GARDENS COLLECTION****Elena Viktorovna Dunayevskaya, Valery Dmitriyevich Rabotyagov**

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Introduction

Lavandin (*Lavandula hybrida* Reverchon) is an interspecific hybrid selected by natural or artificial crossing of *Lavandula angustifolia* Mill. and *L. latifolia* Medic. One of its distinctive features in comparison with origin cultivars is heterosis; that's why it's so interesting from the scientific point of view.

According to morphological, biological and economically valuable characteristics clones of lavandin occupy intermediary position between origin cultivars of *Lavandula angustifolia* Mill. and *L. latifolia* Medic.

The principal regions of lavandin cultivation are France, Spain, Italy, Morocco, Rumania [2, 10]. On the territory of CIS only Nikitsky Botanical Gardens deal with lavandin selection [13].

Favorable effect of lavandin on human is well-known for a long time. In the Ancient world and Middle Ages lavandin served as a medicine to treat contagious diseases, migraine, for wound and burn healing. Avicenne wrote in his work "The Canone of Medicine": "Lavandin decoction releases joint, nerve and rib pain. Its syrup is the most useful medicine to treat nerve disease. That's why those who have weak nerves should take it regularly <...> Lavanda is a great helper to cope with melancholy and epilepsia ..." (quote by Nuraliyev [11], p. 97).

Today literature also emphasizes sedative, anti-inflammatory and diuretic effect of lavender inflorescences [6], which are included into pharmacopoeia of 16 countries of the world [9].

Raw material used for medicine purposes is all over-ground part of lavender and its inflorescences which contain tanning agents, organic acids, flavonoids, coumarins, bitter stuff, furfural and essential oil.

Essential oil composition presents hydrocarbon, aldehyde, ketones, ethers and esters, oxides, more than 100 chemical compounds were identified. The principal components have the following concentration: α -pinene – 0,1 – 1,0%, limonene – 0,2 – 0,5%, 1,8-cineole – 0,1 – 0,5%, linalool – up to 33%, linalilacetate – 32-53%, camphor – 0,2 – 1,5%, borneol – 1,4 – 3,0%, α -terpineol – 0,4 – 0,9%, nerol – 0,4 – 5,7%, lavandulol – up to 15%, geraniol – 0,5 – 1,8%, heranilacetate – up to 1,5%, bornilacetate – up to 0,7%, esters of linalool with valerianic, capronic, butyric and acetic acids (30-60%), tanning agents, coumarins, bitter stuff [3, 4, 12].

Lavender inflorescences are particularly popular in traditional Mediterranean cuisine for aromatization of smoked food, baked goods, sauces, preparation of aroma phytoteas. As a dressing it can be added to soups, snacks, fish dishes [6].

Lavender is a bee plant, 1 ha of plantations yields about 200 kg of honey [9].

Nowadays we have agrotechnology of lavandin cultivation, its morphological and biological properties, component composition of its essential oil having been thoroughly investigated. But lavandin plants of NBG selection haven't been studied for contain of essential [14] macro- and microelements, which are of value for human health.

It's a well-known fact, a lack of essential macro- and microelements provokes disorder in absolutely all biochemical reactions of human body and work of organ system. <...> organism stops developing, isn't capable to continue its biological cycle, as an instance it has disfunction of reproductive system. Introduction of missing element removes signs of its deficit and makes human organism viable again" [15]. For example, having a lack of iron a human body gets anaemia, deficit of calcium, magnesium and potassium causes heart attacks [1].

Therefore this research is aimed at investigating the ability of some vital for human mineral elements contained in over-ground part of marked out NBG selective forms Lavandin (*Lavandula hybrida* Rever.): Ca, Mg, K, Zn, Fe, Mn, Cu.

Concentration of this or that element capable to transform into extract, tincture, decoction or herb infusion wasn't to study in terms of this work.

Objects and research methods

Investigation objects were interspecific hybrids F1 and F2 – results of True Lavender "Record" and "Prima" with amphidiploid lavandins.

Clone 71. (Amphidiploid x "Prima"). Plants are characterized by compact form, large size, height 85 sm, diameter up to 100 sm. Leaves are dark green, wide spear-shaped, by length 8-9 sm, width – 10-12 sm. Inflorescence is dense, discontinuous by length 9,5 – 12,5 sm. Flowers have a dark purple color. Yield makes 104,2 c/ha, mass fraction of essential oil is 2,7%, essential oil crop is 277,5 kg/ha.

Clone 53 (amphidiploids x "Prima"). Plants are compact, big-sized, length 85 sm, diameter - up to 100 sm. Leaves are dark green, wide spear-shaped with length 8-9 sm and width 10-12 sm. Inflorescence is dense, discontinuous by length 9,5 – 12,5 sm. Flowers are dark purple. Yield capacity is 77,7 c/ha, mass fraction of essential oil makes 3,05%, essential oil crop capacity – 239,5 kg/ha.

Allotriploid № 101-84. (Amphidiploid "Record"). Plants are compact, big-sized, 85 sm by length, diameter is up to 100 sm. Leaves are oblong spear-shaped, length 7-10 sm and width 9-11 mm, dark green. Inflorescence is dense, discontinuous by length 6-7 sm with 10-12 verticils and 22-26 flowers on verticil. A number of flowers in an inflorescence reaches up to 300 units. Flowers have light blue color. Yield capacity makes 165-170 c/ha. Mass fraction of essential oil is 2,8%, essential oil crop capacity is 250 ha.

Allotriploid № 175-84. (Amphidiploid x "Prima"). Plants are compact, big-sized, height is up to 150 sm and diameter reaches 140 sm. The floral stems are long (85 sm), radiating from the bottom with branching of the 1st, 2nd, 3rd orders. Leaves are grey and green, oblong spear-shaped, 9-11 sm by length, width – 6-8 mm. Inflorescences are discontinuous, friable, 10-13 sm by length. An inflorescence contains 11-14 verticils, in turn one verticil has 14-24 light purple flowers. Yield capacity makes 75 c/ha. Mass fraction of essential oil is 3,0%, essential oil crop is 240 kg/ha.

Dry ashing of the plant inflorescences during the full blossom was carried out by method of Grishyna and Samoilova [5]. Contain of vital for human elements such as Ca, Mg, K, Zn, Fe, Mn, Cu was identified in the given hydrochloric acid solution applying atomic absorption spectrophotometer C-115 PKC.

Human need in this or that essential elements is quite individual and depends upon gender, age, physical activity, metabolism level and health in general. Nevertheless there are approved by dietology norms of the daily need in macro- and microelement ranged from

minimal necessary till maximum permissible. Content of the study essential elements were compared with these norms in analyzed Lavandin specimens.

Results and discussion

According to our researches all analyzed specimens of lavandin deposit a lot of potassium [table 1).

Table 1
Concentration of some essential elements in lavandin specimens in mg/kg of the raw material

№	Specimen	Fe	Zn	Cu	Mn	K	Ca	Mg
1	Clone 71	0,82	0,33	0,11	0,164	13912,9	110,0	399,4
2	Clone 53	1,09	0,39	1,10	0,163	15988,5	109,0	70,0
3	Allotriploid №101-84	1,10	0,35	1,31	0,187	16063,0	111,0	139,0
4	Allotriploid № 175-84	1,03	0,28	0,12	0,170	27021,5	109,0	65,7
5	Daily human need* in mg	10-20	12-20	1,00 – 2,00	2,00 – 5,00	1300 – 3000	800 – 1600	500 – 750
* Daily human need depends upon his age, gender and physical condition.								

Even clone 71 with the smallest concentration of K among study specimens, deposits more than 4,6 maximum norms of the daily human need (NDHN) in this extremely important macroelement, what is much more than concentration in such recognized potassium sources as peaches, dried apricots, haws. Allotriploid № 175-84 has the highest content of potassium in comparison with all study cases – more than 9 maximum norms of the daily human need, what is twice as much than in dried apricots and 1,7 times much than in fruits of papaw, cultivar Victoria (Fig.1).

It's a well-known fact that potassium is the most important intracellular element-electrolyte and an activator of some ferments functions. It's necessary for cellular nutrition, muscle activity including myocardium, nervous control of heartbeats, support of the stable level of blood pressure, water-salt and acid-base balances, function of neuroendocrinal system. The principal signs of potassium deficit are hyperexcitability, hyperhidrosis, neurocirculatory dystonia, arrhythmia, intestinal colics and asthenia [8].

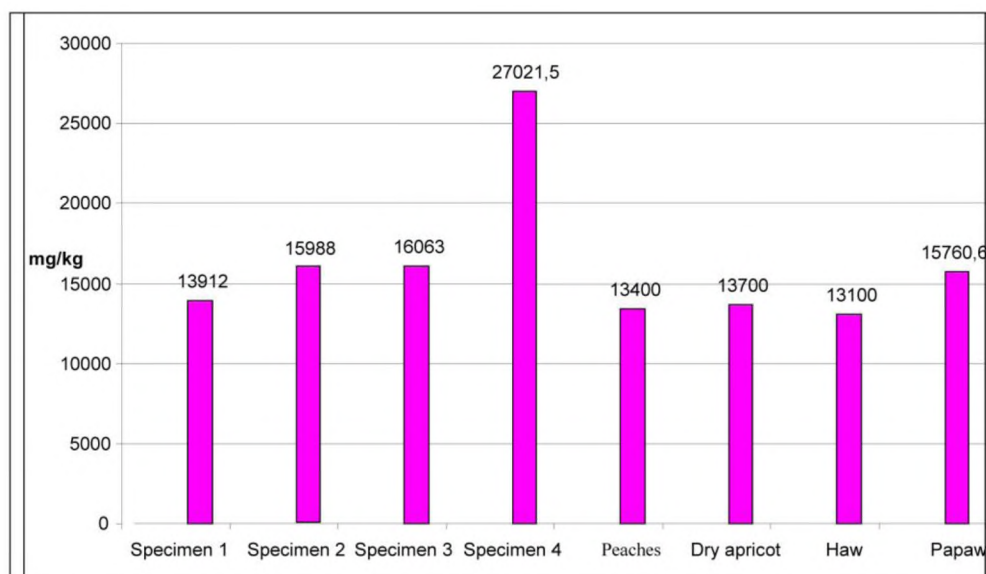


Fig.1 Comparative potassium content in recognized sources and in NBG collection lavender raw material

Probably a high concentration of potassium caused this plant use for treatment of heart rate disorder as a sedative and spasmolytic remedy for a long time. [9].

The study specimens have a considerable difference in copper content. Its concentration rates from minimal – in Clone 71 (1/9 of minimal NDHN) – up to maximum – Clone 53 and Allotriploid №101-84, what is more than minimal norm of the daily need (Fig.2). So high concentration is of great interest, as in previous study specimens of fruit cultures copper content was registered and measured by hundredth of mg [7, 16]. Even in Clone 71 and Allotriploid № 175-84 with copper concentration of much less than in specimens 2 and 3, this number is 6-8 times as much than in fruits of ebony and 3 times as much than in fruits of papaw – a leader in content of biologically active substances (Fig.2). Copper is of great value for human health, as it participates in synthesis of haemoglobin, tissue respiration, connecting tissue metabolism, favors copper digestion, possesses bright anti-inflammatory effect. Copper guarantees normal function of nervous and immune systems. Copper deficit causes hyperexcitability of nervous system, mental and physical retardation of children, disorder of blood formation, scoliosis, osteoporosis and heart diseases [15].

Allowing for mentioned above popularity of lavender tincture on vine since Hippocrates days is quite understandable, as it has been used to treat nervous breakdown, vertigo, cough and cold [9].

In all study lavender specimens a small concentration of iron was revealed, ranged from 1/12 up to 1/9 from minimal norm of the daily human need.

Almost the same content of iron is deposited in Clone 53 and Allotriploid № 101-84, a little bit less in Allotriploid № 175-84. Minimal concentration of this essential element is accumulated in clone 71 (see table 1).

Researching fruits of NBG collection 3 ebony cultivars for mineral composition minimal iron content was registered in fruits of the cultivar “Nikitskaya Bordovaya”. It's approximately 1,4 time as much than maximum iron quantity contained in study lavender specimens (Fig.2).

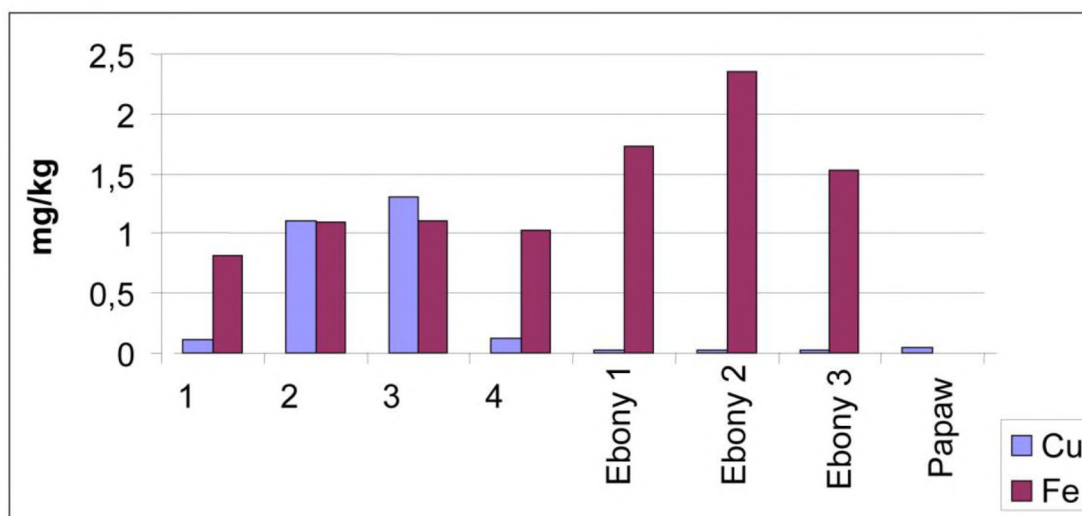


Fig.2 Copper and iron content in lavandin, papaw and ebonny fruit raw material, NBG collection

Being the key microelement for blood formation iron has a considerable effect on human health, efficiency: about 75% of general iron content go to make up haemoglobin, others 25% deposit in liver, spleen and bone marrow.

Iron deficit causes anemia, changes in myocardium and skeletal muscles, inflammatory and atrophic changes of mouth and nose mucous membrane, esophagus disease, chronic gastroduodenitis and immunodeficiency state as well [15].

Iron deficit is the most often phenomena in organism of girls during pubertal period due to physiological peculiarities.

Calcium is a vital macroelement: state of musculoskeletal system and cardiovascular systems are in a direct demand on its concentration in body.

In study inflorescences of lavandin calcium content is approximately equal for all specimens and makes a bit more than 1/7 of the minimal norm of the daily human need (see table 1), what is 2,5 times as much than in ebonny fruits of the cultivar “Souvenir Oseni” and 3,3 times as much than in fruits of “Nikitskaya Bordovaya” cultivar [16].

Magnesium concentration in study specimens is various: the minimal – Allotriploid № 175-84 (0,13 from the minimal norm of the daily human need), the maximum – Clone 71 (0,8 from the minimal norm of the daily human need (see table 1)). In general lavandin accumulates much more magnesium than ebonny does. As the maximum concentration of magnesium in ebonny fruits is almost equal to its concentration in Clone 53 and 5,7 times as much than in Clone 71 [16].

Magnesium is an extremely important macroelement for human vital functions, as it takes part in regulation of neurochemical transmission and muscle excitability, reliefs unstriated muscles, decreases arterial tension [8].

Magnesium deficit is typical for those people who are chronically stressed, suffer from depression and autism, for hyperactive children with syndrome of attention deficit, teenagers with deviant behavior [8]. Magnesium deficit can cause flaccidity, irritability, myotonia, diarrhea, immunodeficiency [15].

Microelement manganese is of great importance for human health which favors bony tissue strength, improves reproductive function and normalizes work of central nervous system, activates ferments necessary for carbohydrate and protein metabolism [14].

In study fruits of three ebony cultivars and 2 cultivars of large-fruited hawthorn and papaw manganese ability wasn't registered because of extremely low concentration [7, 16]. Lavandin specimens have this element in approximately equal concentration from 1/12 from the minimal daily norm in Clone 53 up to the highest value – 1/10 of the minimal norm of the daily human need – in Allotriploid № 101-84 (see table 1).

Significance of zinc is hard to overrate, as it is an integral part of sex and gonadotropic hormones synthesis, many ferments, possesses immunomodulatory effect, antioxidal properties and anticarcinogenic activity. Zinc deficit causes mental insanity, diabetes, cataract, cardio diseases, damage of brain and nervous system, disorder of immunal system, food allergy, skin diseases, chronic tiredness, hearing disorders, indigestion and bad wound healing [15].

Zinc concentration in study lavandin specimens is not considerable and ranges from 1/31 of the minimal norm of the daily human need in Clone 53 up to 1/42 in Allotriploid № 175-84 (table 1). It's worth to note that in previously studied for mineral composition specimens of 3 ebony cultivars from NBG collection the maximum zinc concentration was in fruits of "Souvenir Oseni" [16]. It's roughly equal to minimal zinc content in lavandin study specimens.

Conclusions

In terms of our investigation the following was determined:

- Inflorescences of all lavandin study forms have the highest potassium concentration;
- Allotriploid № 175-84 deposits maximum potassium concentration in comparison with 4 lavandin forms;
- Allotriploid № 101-84 is a leader not only by crop capacity but also by some essential elements concentration such as Fe, Cu, Mn;
- Clone 71 has the maximum magnesium concentration among study lavandin plants.

Gratitudes

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Inflorescence mineral composition (dry combustion) of four selective forms of lavandin was investigated for the first time. These forms were sorted out in Nikitsky Botanical Gardens during full bloom. It was determined, that Allotriploid №101-84 has the best characteristics not only by crop, but also by concentration of some essential elements, such as: ferrous, copper and manganese. Allotriploid № 175-84 accumulates maximum content of potassium in comparison with studied forms of lavandin. Clone 71 contains the highest concentration of magnesium, while clone 53 is a leader by the highest content of essential oil.

Key words: *lavandin; macro- and microelements.*