ESSENTIAL OIL-BEARING AND MEDICINAL PLANTS

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PERSPECTIVE SOURCES OF ESSENTIAL OILS FOR MEDICINE AND PERFUME-COSMETICS

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Introduction

Recent decades people demonstrate a heightened interest to essential oils used as medioprophylactic remedies [2]. Such scientific branches as aromatherapy and aromacorrection of the human psychophysical state require not only natural oils of principal essential oil-bearing cultures, like Lavender [5], but oils of rare hardy aromatic plants as well.

Satureja hortensis makes it possible to increase raw material base of essential oil-bearing plants, used for production of expectorant and antimicrobial medicine to treat bronchopulmonary pathology [8]. Guidance of aromatherapy emphasizes anesthetic, antiseptic and wound healing effect of *Satureja hortensis* essential oil [2]. Typical for this oil burning taste and specific flavor confirms carvacrol content in there. Aqueous-alcoholic extraction of *Satureja hortensis* from the grass inhibits *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginoza* growth [8]. *Calamintha nepeta* is widespread in many countries as diuretic, gastric and enhancing potency medicine.

The objective of this research is to mark out highly-productive forms, potential sources of essential oil and raw material to comply demands of domestic medicine and perfume-cosmetic industry.

Objects and methods of the research

Selective patterns of *Lavandula angustifolia* L., *Calamintha nepeta* (L.) Savi and *Satureja hortensis* L. were being instigated in 2008-2011 at experimental base of SBE RC RIAC of the Crimea, situated within piedmont zone of the Crimea (vil. Krymskaya Roza in Belogorsky region). This location belongs to the IV agroclimatic district, that is upper piedmont, warm, not humid enough climate, goes to northern subdistrict with moderate mild winter [6]. Soils are piedmont carbonate chernozems on eluvium and deluvium of carbonate rocks. Experimental zone is characterized by moderately continental climate: + 10°C period lasts 5,5-6 months, average annual air temperature is 9,8°C according to data of weather station in Belogorsk. Average annual amount of precipitations makes 450-500 mm. Hydrothermal index is 0,92 on average what confirms moderately arid character of agroclimatical conditions during vegetation [4].

Records and observations were carried out according to notes "Selection of essential oil-bearing cultures" [7]. Mass fraction of essential oil in flower-herbaceous material was done being guided by methodological recommendations "Biochemical methods for analysis of essential oil- bearing plants and essential oils" [1]. Component composition of essential oil was determined applying chromatograph Agilent Technologies 6890 mass-spectrometer sensor 5973. chromatographic column – capillary HP-5 (30 m long); inside diameter – 0,32 m. Carrier gas is helium, stream velocity – 1,5 ml/m. Temperature of input trial heater is 250ºC. Thermostat temperature is set in range from 50 till 320 ºC with velocity of 4ºC per minute. Mathematical data treatment is carried out according to “Method of the field experience” by B.A. Dospekhov [3].

Results and discussion

Fifteen selective clones of *C.nepeta* were investigated and as a result it was found out that essential oil content in the raw material ranged from 0,417 till 0,625%, in the bonedry material – 0,822-1,568%; crop capacity – 236-555 g/plant; essential oil yield – 1,3 – 2,9g/plant. As to crop capacity of verdurous masses average sum total with 95% probability ranged 308÷432g/plant, while essential oil content in the raw material was 0,520÷0,580%, in the bonedry material – 1,186÷1,418 (table 1).

5 clones (№№ 3-а, 4-II, 3-в, 68, 3-б) with crop capacity of raw material ranged from 447-555g/plant were marked in terms of this research. These indices were found 3,4-28,5% more than average total sum. At the same time 4 clones (№№ 38-5, 11-5, 68, 11) with mass fraction of essential oil in the raw material ranged from 0,588-0,625% were marked out, as their parameters occurred 1,4-7,8% more than average total sum. As to essential oil yield 3 clones (№№ 3-в, 68, 3-б) significantly exceeded average total sum (2,0±0,3 g/plant) – 17,4-26,1% more. A complex of economically valuable characters clone №68 (see table 1) was emphasized as its raw material and essential oil are capable to increase raw material base for production of domestic medicines and cosmetic products.

Table 1

Crop capacity characteristics of *Calammtha nepeta*, 2008-2011

Clone	Crop capacity of verdurous masses, g/plant	Mass fraction of essential oil in the raw material, %		Essential oil yield, g/plant
		raw	Bonedry	
1	2	3	4	5
67-st	281	0,417	0,822	1,3
3-а	502	0,479	1,023	2,3
4-II	447	0,533	1,208	2,3
65	383	0,550	1,222	2,1
11-1	239	0,550	1,276	1,3
3-в	555	0,517	1,404	2,7
4	412	0,567	1,459	2,3
38-5	256	0,621	1,568	1,6
66	424	0,538	1,318	2,3
11-5	236	0,600	1,477	1,4
11-2	296	0,571	1,412	1,7
68	491	0,588	1,484	2,9
3-б	494	0,550	1,120	2,7
38	296	0,550	1,180	1,7
11	245	0,625	1,558	1,5
$\bar{x}\pm t_{05}S_{\bar{x}}$	370±62 (308÷432)	0,550±0,030 (0,520÷0,580)	1,302±0,116 (1,186÷1,418)	2,0±0,3 (1,7÷2,3)

Rate of *Lavandula officinalis* hybrids gave an opportunity to get economically valuable forms necessary for industry. Crop capacity of study clones was in terms of standard values. Mass fraction of essential oil of all study samples significantly exceeded values of Stepnaya cultivar. As to essential oil yield clone № 417-3 was 47% more than a control sample, while others had an advantage at this parameter (table 2). Bush shape character of all clones significantly exceeded standard and were rated as 7-9 points. Sample № 417-3 (9 points) was found as the most winter resistant, № 372-1 (47,29%) was marked out as a clone with the highest content of linalyl acetate. Clone № 417-3 was a leader according to economically valuable characters.

Table 2

Characteristics of *Lavandula officinalis* selective samples, 2008-2010

Sample №	Inflorescence productivity, g/bush	Mass fraction of essential oil in raw inflorescences, %	Essential oil yield		Linalyl acetate content in essential oil, %	Autumn regrowth, point	Bush shape, point	Winter resistance, point
			g/bush	± standard				
Steppe-st	228	1,310	2,96	0	34,14	9	5	7
410-1	201	2,010	3,95	+33	30,00	7	9	7
393-19	199	1,970	3,88	+31	35,13	7	7	7
417-3	221	2,050	4,34	+47	37,62	7	7	9
372-1	199	1,930	3,79	+28	47,29	7	7	7
HCP_{05}	64,5	0,270	1,36					

In terms of this research 34 essential oil components of *S. Hortensis* selective sample were marked out while studying its qualitative composition (fig., table 3), main of them are: carvacrol (42,7%), γ-terpinene (26,5%), α-terpinene (6,9%), p-cymene (6,9%). Content of these components makes it possible to recommend essential oil of this sample for production of phytopreparations with expectorant, wound healing, bactericidal and fungicidal effects.

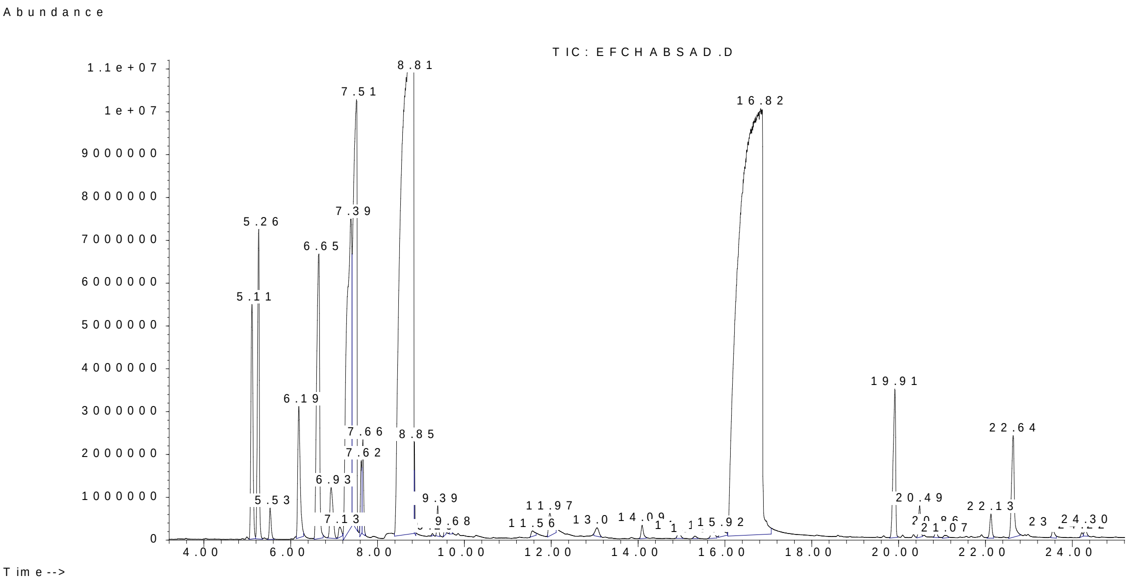

Fig. Chromatogram of *Satureja hortensis* essential oil

Table 3

Component composition of *Satureja hortensis* essential oil

№	Emergence time, min	Identified components	Mass fraction, %
1	2	3	4
1	5.106	α-tuyen	2,119
2	5.264	α-pinene	2,432
3	5.526	camphene	0,252

4	6.189	β-pinene	1,406
5	6.649	β-myrcene	3,697
6	6.933	α-phellandrene	0,691
7	7.127	carene	0,126
8	7.388	α-terpinene	6,922
9	7.515	p-cymene	6,874
10	7.623	β-phellandrene	0,464
11	7.663	limonene	0,523
12	8.814	γ-terpinene	26,466
13	8.850	trans-sabinene hydrate	0,181
14	9.265	1-methyl-4-(1-methylethyl) benzoate	0,014
15	9.386	α-terpinolele	0,209
16	9.544	cys-sabinenehydrate	0,051
17	9.684	linalool	0,036
18	11.565	corneol	0,086
19	11.971	cerpen-4-ol	0,415
20	14.091	carvacrol methyl ether	0,139
21	14.938	cyclohex-2-en-1-on	0,075
22	15.304	p-ment1(7)-en-2-on	0,032
23	15.705	m-thymol	0,098
24	15.917	p-thymol	0,150
25	16.824	carvacrol	42,690
26	19.913	β-caryophyllene	1,611
27	20.486	aromadendrene	0,284
28	20.860	α-humulene	0,086
29	21.068	allo-aromadendrene	0,043
30	22.128	lyeden	0,230
31	22.637	β-bisabolene	1,235
32	23.553	α- bisabolene	0,100
33	24.221	spathulenol	0,037
34	24.297	Caryophyllenoxide	0,085

Conclusions

As a result of this investigation there are promising sources of essential oil marked out for medicine, perfume and cosmetic industry. At the same time clone of *Calamintha nepeta* (crop capacity of 491 g/plant and mass fraction in the raw material 0,588%) and sample of *Satureja hortensis* (contains in essential oil 42,7% of carvacrol and 26,5% of γ-terpinene) are both appreciated in special cosmetics and pharmaceutical industry. Clone of *Lavandula officinalis* with hybrid origin - № 417-3 - with inflorescence crop capacity of 221 g/bush, mass fraction of essential oil 2,050% and linalyl acetate concentration 37,62%, essential oil yield 4,34 g/plant is promising material for high perfume industry.

References

1. Biokhimicheskiye metody analiza efiromaslichnyh rasteny i efirnyh masel. – Simferopol, 1972. – 107 s.
2. *Voitkevich S.A.* Efirniye masla dlya parfumerii i aromaterapii. – M.: Pishchevaya promyshlennost, 1999. – S. 259.
3. *Dospekhov B.A.* Metodika polevogo opyta (s osnovami statisticheskoy obrabotki rezultatov issledovany). – M.: Agropromizdat, 1985. – 351 s.
4. Metodicheskiye rekomendatsii po analizu pogodno-klimaticheskih uslovy i rezultatov vyrashchivaniya selskokhozyaistvennyh kultur. – Simferopol, 2008. – 55 s.
5. *Nazarenko L.G., Afonin A.V.* Efironosy yuga Ukrainy. – Simferopol: Tavriya, 2008. – S.34.
6. *Savchuk L.P.* Klimat predgorya Kryma i efironosy. – Simferopol, 2006. – 76 s.

7. Selektsiya efiromaslichnyh kultur (metodicheskiye ukazaniya) / Pod red. d-ra s-h.nauk, prof. A.I. Arinshtein. – Simferopol, 1977. – 150 s.

8. *Tanskaya Yu.V.* Farmakognosticheskoye izucheniye chabera sadovogo (*Satureja hortensis* L.), introdutsirovannogo v Stavropolskom kraye: Avtoref.diss…kand.farm.nauk: 15.00.02 / Pyatigorskaya gosudarstvennaya farmatsevticheskaya akademiya Federalnogo agenstva po zdravoohraneniyu i sotsialnomu razvitiyu. – Pyatigorsk, 2009. – 27 s.

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Selective patterns of *Calammtha nepeta, Lavándula angustifólia* and *Satureja hortensis* were investigated to breed high-productive forms. The article presents data of essential oil and linalyl acetate content, crop capacity, winter resistance of lavender clones. There are also characteristics of *Calammtha nepeta* clones according to economic attributes and *Satureja hortensis* by component composition of its essential oil. Perspective sources of essential oils for medicine and perfume-cosmetic industry were marked out as well.

Key words: *Calammtha nepeta, Lavándula angustifólia, Satureja hortensis, essential oil.*

REPRODUCTIVE BIOLOGY OF PLANTS

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REPRODUCTIVE STRUCTURES FORMATION IN *TORREYA GRANDIS* FORTUNE EX LINDL. UNDER THE CONDITIONS OF SOUTH COAST OF THE CRIMEA

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Introduction

One of the most important issues of botanical gardens is to extend species and form assortment of plants, used in ornamental gardening. Recent decades plants that possess not only ornamental characteristics but food and medicinal value are especially investigated.

Coniferous plants are widespread in the field of ornamental gardening due to their evergreen needles keeping all year round, prolonged life-span, diversity of forms and phytoncides that have health giving qualities. Moreover seeds of some coniferous cultivars as follows possess high nutritive value: among well-known pines (*Pinus sibirica* Du Tour, *Pinus koraiensis* Siebold & Zucc., *Pinus pumila* Regel, *Pinus mugo* Turra, *Pinus pinea* L., *Pinus coulteri* D.Don and etc.) there is *Torreya grandis* Fortune ex Lindl. (family Taxaceae) as well, which inhibits in eastern regions of China and is cultivated in Europe and America as an ornamental plant. In China *Torreya* is an important industrial culture as its seeds besides high nutrition value and interesting taste contain vitamins, mineral elements, proteins and indispensable fatty acids. In addition different plant parts have antihelminthic, anti-inflammatory, antifungal and antibacterial effects as well as antitumoral action [6]. Biochemical analysis of *Torreya* oil extracted out of seeds revealed that it includes 18 components and principal are: linoleic (42,02%) and oleic (32,14%) acids. In the course of *Torreya* study it was found out this oil possesses antioxidant activity and capacity to output