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The research of essential oil's chemical composition in species of genus *Cupressus* L., growing in Crimean south coast

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Summary. The study revealed the qualitative composition and quantitative content of essential oils from needles of 10 species of *Cupressus* L., growing on the Southern Coast of the Crimea. Needles of *Cupressus arizonica* Green can be recommended as a potential raw material for producing high-quality essential oils.

Keywords: *Cupressus* L., essential oil, terpenoids.

Introduction. Cypresses are related to kinds, the introduction of which began long time ago. The first planting of Mediterranean cypresses has been known since 1778. For the short period this kind became one of the most spread park trees on the Crimean South coast. Other kinds of cypresses were represented later in fifties of XIX century [1]. The information about composition of cypress's essential oils, growing in conditions of the South Crimean Coast, were gained in 80s of XX century. These researches deal with only monoterpene composition. Due to development of equipment and methodological bases and highly increased needs of population in natural medical products, the aim of this work was more exact research of essential oil composition in different kinds of cypresses in period of their maximal accumulation.

Materials and Methods. Needles of 10 species of *Cupressus* L. were collected in arboretum Nikitskiy Botanical Garden — National Scientific Centre (Southern Coast of the Crimea, Ukraine) in 2007-2010. Samples of needles were separately subjected to hydrodistillation for 5 h using a Ginsberg-type apparatus. Composition oils measured using Agilent Technology 6890 chromatograph with a mass spectrometer detector 5973, HP-1 column, length 30 m, internal diameter — 0.25 mm. Oven temperature was programmed from 50 to 250 ˚C at a rate 4 ˚C/min. Injector temperature — 250 ˚C, carrier gas — helium flow rate — 1 cm^3/min. The transfer from the gas chromatograph to a mass spectrometric detector temperature reached 230 ˚C. Source temperature was maintained at 200 ˚C. Electron ionization at 70 eV was carried out in the ranking of the masses m/z 29 to 450. The identification of every component was achieved by comparing their mass spectra with those reported in NIST 05-WILEY.

Results and Discussion. Minimal amount of essential oil in cypress needles is in spring months (March-May), when it is impossible to highlight it. Next minimum is in the second half of summer (June-August, depends on species). At the same time the maximal contest of essential oil is in autumn period (October-November). Maximal meaning of essential oil mass fraction (% on dry mass) in needles is: in *Cupressus funebris* Endlicher (sin. *Chamaecyparis funebris* (Endl.) Franco) and *Cupressus arizonica* var. *glabra* (Sudw.) Little (sin. *Hesperocyparis glabra* (Sudw.) Bartel) — 0,43 %; *Cupressus torulosa*

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D.Don — 0,39 %; *Cupressus macnabiana* Murr. (sin. *Hesperocyparis macnabiana* (A. Murray bis) Bartel) — 0,33 %; *Cupressus lusitanica* Mill. (sin. *Hesperocyparis lusitanica* (Mill.) Bartel) — 0,21 %; *Cupressus sempervirens* L. — 0,18 %; *Cupressus goveniana* Gord. (sin. *Hesperocyparis goveniana* (Gordon) Bartel — 0,16 %); *Cupressus guadalupensis* Wats. (sin. *Hesperocyparis guadalupensis* (S. Watson) Bartel) — 0,11 %; *Cupressus duclouxiana* Hickel — 0,08 %; *Cupressus macrocarpa* Hartweg (sin. *Hesperocyparis macrocarpa* (Hartw. ex Gordon) Bartel) — 0,05 %.

On purpose of distinguishing the meaningful components in essential oil, which can influence its value, the qualitative composition of oil in period of maximal accumulation (October-November) was researched. Over 140 components were identified (table 1).

Table 1

The main components of essential oil in needles of different species of Cupressus L.

	Component	*Cupressus sempervirens*	*Cupressus torulosa*	*Cupressus funebris*	*Cupressus duclouxiana*	*Cupressus arizonica*	*Cupressus lusitanica*	*Cupressus macnabiana*	*Cupressus macrocarpa*	*Cupressus guadalupensis*	*Cupressus goveniana*
1	2	3	4	5	6	7	8	9	10	11	12
1.	α-thujene	0,19	1,71	0,93		0,55	0,15	0,43	0,38		0,40
2.	α-pinene	43,82	7,99	18,27	2,68	16,58	0,89	0,91	2,93	20,11	1,09
3.	camphene	0,28	0,25	0,15						0,44	0,94
4.	sabinene	0,65	23,39	13,72	0,47	3,04	1,36	7,95	7,13	0,15	4,05
5.	β-pinene	1,71	0,48	0,82	0,08	0,41		0,13	0,19	2,16	
6.	myrcene	2,42	3,90	3,14	0,51	1,87	0,55	3,75	1,67	2,10	2,29
7.	δ-3-carene	12,90		0,07	0,13		1,23		11,58	0,09	2,12
8.	α-terpinene		3,58	1,58	0,09	1,09	0,28	2,43	1,64		1,53
9.	cymene						0,96				
10.	*p*-cymene	0,35	0,27	0,18		0,59		0,35	1,71		1,62
11.	limonene	2,91	2,69	2,25	15,32	7,28	1,96	7,20	2,08	3,83	8,23
12.	1,8-cineole								0,98		
13.	γ-terpinene	0,20	5,90	2,78	0,19	1,45	0,66	3,79	3,86	0,08	2,32
14.	terpinolene	1,88	2,76	1,70	0,40	1,25	0,52	1,63	1,84	0,20	1,41
15.	linalool	0,42		0,12		0,91	0,33	0,38	0,38		0,29
16.	camphor					0,13	1,05	0,62		0,17	16,37
17.	2,6,6-trimethyl-cyclohept-3-en-1-one							13,70			
18.	isobutyl butyrate								1,00		
19.	umbellulone	0,15			0,20	6,75	4,36	0,58	0,25		6,69
20.	terpinen-4-ol	0,88	14,96	7,70	0,65	4,49	6,01	11,66	23,96	0,26	10,33
21.	α-terpineol	0,52	0,60	0,58	0,18	0,62	0,52	1,38	2,00	0,46	0,90
22.	citronellol					0,41		1,46	1,32	0,12	0,45
23.	thymol, methyl ether					0,27					1,32
24.	bornyl acetate	0,42	0,82	0,34	0,84	0,18					8,67
25.	thymol					0,90	1,22				3,02
26.	1- terpinyl acetate	0,33						1,37			
27.	terpinen-4-yl acetate										1,45
28.	terpinen-4-ol acetate		0,13			0,45	0,32		1,32		
29.	4-terpinyl acetate	1,06									
30.	α-terpinyl acetate	6,42	1,14	0,91	0,19	1,99	1,74	23,45			5,98
31.	α-ionol			3,35							

Continuation of Table 1

1	2	3	4	5	6	7	8	9	10	11	12
32.	caryophyllene	0,15	0,41	0,62	1,06	0,30	0,61				
33.	dihydro-β-ionol			2,77							
34.	β-cubebene				2,87						
35.	*cis*-muurola-3,5-diene		3,35	2,80		4,43	3,65		1,47		
36.	*cis*-muurola-4(14),5-diene	0,26	6,76	6,27	6,19	10,33	12,10		2,96	0,19	
37.	germacrene-D	1,16		0,88						0,26	
38.	cadina-3,5-diene			2,63							
39.	citronellyl propionate							1,49			
40.	epizonarene	0,15	1,99			3,72	4,42		1,46	0,33	
41.	isoledene				2,50						
42.	δ-cadinene	0,23		1,19	1,51						
43.	*cis*-kalamenene		1,11	0,52		3,08	4,46		0,45	1,10	
44.	italicene ether					0,63	1,50				
45.	*cis*-muurola-5-en-4-β-ol		0,41	0,57		0,93	0,85				
46.	elemol			4,52					0,24	0,10	
47.	*cis*-muurola-5-en-4-α-ol		0,59	1,39		1,27	1,26				
48.	nerolidol					0,23			2,28		
49.	caryophyllene oxide		0,35	0,44	2,97	0,16	0,22		0,22	0,45	0,22
50.	cedrol	12,57				1,99	4,62	0,54			0,10
51.	cubenol			1,19						0,28	
52.	1-epi-cubenol				0,97						
53.	α-acorenol					3,97	13,42				
54.	β-acorenol					0,59	1,83				
55.	γ-cadinol	0,31	0,58		0,39				0,25	2,04	
56.	epi-α-cadinol			0,86	1,19	1,03	2,26				
57.	α-cadinol	1,01	3,16	3,94	5,61	2,17	4,86		0,96	3,43	
58.	14-norkadin-5-ene-4-one			0,40	0,18	3,08	4,21				
59.	cupressene				0,69	0,17			1,20	1,67	
60.	kaur-15-ene							4,54	1,87	2,56	0,20
61.	*epi*-manoiloksid		0,48			0,74	1,00	0,83	0,64	12,50	1,43
62.	manoiloksid			0,13	1,31					4,00	0,32
63.	rimuene				0,93				0,21		
64.	abieta-8(14),9(11),12-triene				4,07						
65.	dihydro abietane			0,30		0,16			1,11	1,17	0,21
66.	isopimaradiene	1,88									
67.	phyllocladene		1,27			1,96	0,55		9,88	0,37	1,89
68.	13(16),14-labdien-8-ol	0,93	3,45	3,38	9,05					7,69	
69.	kauran-16-ol									1,40	
70.	nezukol				0,29	2,23	0,34	3,42			5,95
71.	totarol acetate				4,66						
72.	phyllocladanol						1,21				
73.	totarol	0,28	1,80	1,10			0,79	0,13		1,21	0,11
74.	ferruginol	0,29	0,22		0,89		0,25			0,43	
Total identified compounds		98,60	99,66	98,89	77,64	96,84	90,33	97,35	97,17	75,85	97,64

Conclusion. Gaining information about main components of composition in essential oil of needles from cypresses is mainly correlates with information from literature [2-6]. But the further the country of growing cypresses is from the South coast of Crimea, the more differences in chemical composition of essential oil can be seen. Though dominant components are still in large amount.

Дослідження хімічного складу ефірних олій видів роду *Cupressus* L. в умовах Південного узбережжя Криму

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Резюме. Досліджено якісний склад і кількісний вміст ефірних олій із гілок 10 видів *Cupressus* L., які зростають на Південному узбережжі Криму. Гілки *Cupressus arizonica* Green можуть бути рекомендовані як потенційна сировина для виробництва високоякісних ефірних олій.

Ключові слова: *Cupressus* L., ефірна олія, терпеноїди.

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