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CHEMICAL COMPOSITION OF ESSENTIAL OILS FROM LEAVES OF *Rhododendron dauricum* AND *R. aureum*

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Rhododendron dauricum L. and *R. aureum* Georgi. (Ericaceae) are medicinal plants used in Tibetan medicine to treat several pathological conditions [1]. Phenolic and terpenoid compounds have been observed previously in these plants [2]. In addition, the compositions of essential oils of both species growing in Russia (Khabarovsk Territory [3], Amur [4], Irkutsk Oblast, Buryatiya [5]) and in China [6] have been reported. Our goal was to study the dynamics of essential oil (EO) composition change of leaves of *R. dauricum* and *R. aureum* collected in the vicinity of Lake Baikal during June-August 2008 and in Irkutsk Oblast regions (*R. dauricum*, experimental plot of SIPFB, Irkutsk; *R. aureum*, Utulik, Slyudyansk Region).

The species were identified by Candidate of Biological Sciences T. A. Penzina [Herbarium samples of raw material (leaves) are preserved in the SIPFB, No. RD128/08-RD130/08, RA064/08-RA066/08). EO was obtained from fresh raw material (storage time <5-6 h) by steam distillation in a Clevenger apparatus for 5 h. Extraction of the distillate with hexane produced an additional amount of EO that was combined with the main portion. EO was studied by GC—MS (Agilent Technologies with mass-selective detector, HP-Innowax column, 30 m/250 μm/0.50 μm, 50-250°C temperature gradient, heating rate 2°/min, He carrier gas, flow rate 1 mL/min). Table lists the analytical results for EO from *R. dauricum* and *R. aureum*.

About 30 components were observed in EO from *R. dauricum*. Among these *trans*-caryophyllene (June, August) and γ-cadinene (July) dominated. The high variability of EO composition during vegetation of the species is noteworthy. Thus, whereas the June samples were dominated by *trans*-caryophyllene (19.10%), γ-cadinene (13.95%), β-gurjunene (10.46%), and humulene (10.20%); the July and August samples had only traces of β-gurjunene and humulene and high amounts of α-amorphene (8.59-10.00%). The EO content was highest (0.13%) in August. According to the literature, the principal components of *R. dauricum* EO were limonene, α-pinene, and *p*-cymene [4]; α-pinene, tetradecane, and 1,2-benzenedicarboxylic acid [5]; and caryophyllene, humulene, and caryophyllene oxide [6].

Studies of EO from *R. aureum* leaves found that the dominant component of the volatile terpenoid complex was the tricyclic aristolane sesquiterpene calarene, the content of which reached 16-48% (of the EO mass). The content and composition of EO varied during the vegetative period. Its content increased toward autumn (0.18%). The components also changed. The concentration of aristolane derivatives (calarene and aristolene) decreased whereas those of burbonanes (β-burbonene) and cadinanes (α-cadinol and β-cadinene) increased. The Baikal population of *R. aureum* studied by us differed from that away from Lake Baikal, the principal EO components of which were hexanoic acid, carvacrol, and α-pinene [5].

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TABLE 1. Compositions of Essential Oils from Leaves of *Rhododendron dauricum* and *R. aureum*

Compound	*Rh. dauricum* (day and month of collection)			*Rh. aureum* (day and month of collection)		
	21.06	23.07	21.08	25.06	22.07	28.08
α-Pinene	Tr.*	Tr.	0.80			
β-Pinene	Tr.	Tr.	0.80			
Limonene	0.45	0.55	0.76			
cis-Ocimene		Tr.	0.16			
γ-Terpinene	Tr.	Tr.	0.29			
β-Fenchyl alcohol		Tr.	0.24			
α-Bornylacetate	0.61	2.75	2.97			
Sabinylacetate	Tr.	2.74	5.07			
α-Ylangene	0.63	0.60	0.64	Tr.	0.22	0.55
α-Copaene	1.48	1.59	1.48	Tr.	0.37	1.00
β-Burbonene	0.92	0.88	0.45	0.91	2.06	9.74
β-Elemene	0.31	Tr.	Tr.			
Aristolene				1.52	0.77	Tr.
trans-Caryophyllene	19.10	10.13	16.98			1.91
Humulene	10.20	2.14	1.15			
trans-β-Farnesene	0.49	0.67	1.01			
Calarene				48.76	36.16	16.17
Aromadendrene				5.32	0.94	0.16
α-Amorphene	Tr.	8.59	10.00	1.60	1.21	0.58
α-Muurolene	8.72	2.41	1.03			
β-Selinene	6.87	0.45	0.31	2.07	1.47	1.50
α-Selinene				5.16	5.13	4.81
α-Cubenene		Tr.	2.81			
β-Gurjunene	10.46	Tr.				
(–)-Isoledene	Tr.	0.45	0.58			
α-Muurolene	0.66	2.50	1.56			
δ-Cadinene				Tr.	0.39	0.21
γ-Cadinene	13.95	17.45	14.42	3.27	0.49	1.15
β-Cadinene				7.18	0.57	2.09
α-Cadinene				1.11	Tr.	Tr.
cis-γ-Bisabolene	0.75	0.55	1.11			
α-Calacorene	0.22	0.50	0.68	0.21	0.44	0.22
Germacrene B	0.51	0.48	0.47			
Palustrol	Tr.	0.34	Tr.			
Caryophyllene oxide	1.41	4.94	6.47		Tr.	2.79
Humulene oxide	0.90	0.60				
τ-Cadinol	0.47	2.23	1.54	0.86	1.42	
τ-Muurol					Tr.	0.94
α-Cadinol	0.50	2.75	1.25	0.88	0.73	1.11
Kaurene D				0.73	2.17	5.33
Identified, %	79.61	64.15	75.03	79.58	54.54	50.26
EO content, %**	0.09	0.10	0.13	0.15	0.16	0.18

*Tr, trace (<0.1%); **essential oil content, % of fresh raw material mass.

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