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CONSTITUENT COMPOSITION AND BIOLOGICAL ACTIVITY OF ESSENTIAL OIL FROM *Artemisia sublessingiana*

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Artemisia sublessingiana Krasch. ex Poljakov (Asteraceae) is a perennial herbaceous plant that grow in eastern, central, southern, and southeastern Kazakhstan [1].

Raw material for the studies was collected in the budding phase during an expedition in the third decade of August 2019 in the vicinity of Zhezqazghan (Karaganda Region). A specimen (2019.08.28.04.01) is preserved in the herbarium of the Biology-Geography Faculty of E. A. Buketov Karaganda University.

Previously, flavonoids (isorhamnetin-3-*O*-rutinoside and 5,7,4′-trihydroxy-6,3′-dimethoxyflavone) and a sesquiterpene lactone (arsubin) [1, 2]; the flavonoids eupatilin, 3′,4′-dimethoxyluteolin, 5,7,3′-trihydroxy-6,4′,5′-trimethoxyflavone, hispidulin, apigenin, and velutin and the sesquiterpene lactone 8α,14-dihydroxy-11,13-dihydromelampolide [3] were isolated from this plant. Compounds isolated by us were tested *in silico* against COVID-19 main protease enzyme (M^{pro}). Flavonoid compounds turned out to be highly promising with respect to the discovery of drugs for the COVID-19 pandemic [3].

The contents of the valuable constituent santonin in various *Artemisia* species were reported [4]. It was found that *A. sublessingiana* contained ~0.16 g of santonin per 100 g of air-dried raw material. The elemental composition of ash from *A. sublessingiana* and the fatty-acid and amino-acid compositions were previously studied [5].

According to the literature, the essential oil composition of *A. sublessingiana* has not been previously studied. In continuation of the determination of essential oil compositions of *Artemisia* species [6–8], it was studied by us using gas-chromatography–mass-spectrometry (GC-MS).

Essential oil of *A. sublessingiana* was obtained from various plant parts (aerial part, seeds, stems) by steam distillation in a Clevenger apparatus using hexane as a trap [9].

GC-MS analysis of *A. sublessingiana* essential oils was performed under conditions analogous to those in the literature [10] using a Restek Rxi®-1ms capillary column (0.25 mm × 30 m × 0.25 μm). Constituents were identified using the NIST 2014 database. Table 1 presents the constituent composition of the *A. sublessingiana* essential oils. The main constituents (> 3.0%) of the essential oils from the aerial part were 3-thujanone (18.9%), chrysanthenone (3.6%), camphor (17.9%), *cis*-chrysanthenyl acetate (31.3%), and nerol acetate (3.1%); from seeds, 1,8-cineol (12.0%), β-thujone (31.8%), 3-thujanone (18.4%), and camphor (14.8%); from stems, 1,8-cineol (11.8%), β-thujone (15.5%), 3-thujanone (34.3%), and camphor (17.2%).

Literature data were used to identify obscure constituents of the essential oil such as artedouglasia oxides A, C, and D and laciniata furanones E, F, and H [11, 12].

The cytotoxic activity of the essential oils from *A. sublessingiana* was studied using *Artemia salina* larvae and the literature method [13]. DMSO was used as the solvent. The antibiotic actinomycin D or staurosporine was used as a control. The experiments found that essential oil obtained from the aerial part at all concentrations exhibited cytotoxicity with lethality of larvae reaching 96%. Essential oil from seeds was cytotoxic at all concentrations with lethality of 75–96%. Essential oil from stems at concentrations of 10 and 5 mg/mL was cytotoxic with lethality of larvae reaching 96% while cytotoxicity was not found at a concentration of 1 mg/mL.

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TABLE 1. Constituent Composition of Essential Oil from *A. sublessingiana*

Constituent	RII	Essential oil content, %		
		stems	aerial part	seeds
7-Methyl-3,4-octadiene	843	0.2		0.1
Ethyl 3-methylbutanoate	848	0.1	0.2	0.1
Tricyclene	915	0.2	0.1	0.1
α-Pinene	925	0.2	1.2	0.3
Camphene	939	2.2	1.8	2.3
Sabinene	963	0.7	0.2	0.8
β-Pinene	966	0.2	0.1	0.2
Mesitylene	983		0.2	
Pseudocumene	983	0.1		
Unk. 1	985	0.1		
α-Terpinene	1008	0.2		0.2
1,2,4-Trimethylbenzene	1010		0.2	
α-Cymene	1016	0.7	0.4	0.8
α-Limonene	1020		0.1	
β-Phellandrene	1021			0.1
1,8-Cineol	1027	**11.8**	**1.1**	**12.0**
γ-Terpinene	1051	0.4	0.1	0.3
cis-Sabinene hydrate	1068			0.1
Unk. 2	1085		0.1	
Filifolone	1097		0.6	0.1
β-Thujone	1106	**15.5**	**1.5**	**31.8**
3-Thujanone	1115	**34.3**	**18.9**	**18.4**
Chrysanthenone	1118	**0.6**	**3.6**	**0.6**
α-Campholenal	1121		0.1	
cis-2-Menthenol	1121			0.5
trans-Pinocarveol	1135		0.9	0.3
cis-Sabinol	1136			0.1
Camphor	1141	**17.2**	**17.9**	**14.8**
Unk. 3	1144	0.5		
Pinocarvone	1153	0.5	0.9	0.3
cis-Chrysanthenol	1157	0.5	0.3	0.3
Isothujol	1159	0.1		
1,3,4-Trimethyl-3-cyclohexenyl-1-carboxaldehyde	1160	0.1		
Borneol	1163	1.5	0.3	0.9
Terpinen-4-ol	1171	1.2	0.4	0.9
p-Cymen-8-ol	1180	0.2	0.2	0.1
α-Terpineol	1187			0.4
Myrtenal	1190	0.2	0.2	0.1
Myrtenol	1193	0.6	0.2	
3-Methylbut-3-enyl (*E*)-2-methylbut-2-enoate	1195		0.1	
trans-Piperitol	1201			0.2
Verbenone	1203	0.1		
Unk. 4	1207	0.3		
p-Cymenol	1231	0.1		
Ciminal	1235	0.2		0.1
Carvone	1241	0.3	0.3	0.2
Piperitone oxide	1249	0.1		
Piperitone	1253	0.6		0.2
***cis*-Chrysanthenol acetate**	1254		**31.3**	
α-Citral	1265		0.2	
Bornyl acetate	1280	0.1	0.5	
Unk. 5	1281		0.1	
trans-Sabinyl acetate	1289	0.8	0.5	0.5
Methyl *cis*-cinnamate	1297		0.2	
Thymol	1299			0.1

TABLE 1 (continued)

Constituent	RII	Essential oil content, %		
		stems	aerial part	seeds
Carvacrol	1302	0.2		
Unk. 6	1309	0.1	0.7	0.1
Myrtenyl acetate	1318		0.2	
Hexyl tiglate	1329		0.2	
trans-Dihydrocarvyl acetate	1332			0.1
α-Terpinyl acetate	1341			0.1
cis-Chrysanthenyl propionate	1346		0.1	
Nerol acetate	1379		**3.1**	
2-(Acetylmethyl)-3-carene	1389		0.5	
cis-Jasmone	1392	0.3		0.2
2-Ethylidene-6-methyl-3,5-heptadienal	1394	0.1	0.8	0.2
Isocaryophyllene	1403			0.1
Aristolene	1454	0.1	0.2	0.1
cis-Muurol-3,5-diene	1459			0.1
Germacrene D	1460		0.3	
2-Isopropenyl-4a,8-dimethyl-1,2,3,4,4a,5,6,7-octahydronaphthalene	1462		0.3	
γ-Gurjunene	1473			0.1
Artedouglasia oxide C	1499	0.2		0.1
Laciniata furanone G	1502	0.2		0.2
Artedouglasia oxide A	1513	0.3		0.1
Laciniata furanone F	1519	0.3		0.1
Laciniata furanone E	1528	0.2		0.2
Laciniata furanone H	1539	0.2		0.1
Spathulenol	1562	0.2	0.2	0.2
Artedouglasia oxide D	1565	0.2		
2-Phenylethyl tiglate	1572		0.5	
Isobutyl pentanoate	1581			0.2
τ-Cadinol	1646		0.1	
(1*R*,7*S*,*E*)-7-Isopropyl-4,10-dimethylenecyclodec-5-enol	1676		0.1	
Squalene	2803			0.4
Total		95.3	92.3	91.0

TABLE 2. Antiradical Activity of Essential Oils at Various Concentrations, %

Sample	Concentration, mg/mL				
	0.1	0.25	0.5	0.75	1.0
Butylhydroxyanisole (BHA)	80.82 ± 4.30	81.23 ± 2.22	82.30 ± 3.17	83.08 ± 2.33	83.88 ± 2.01
A. sublessingiana (seeds)	20.32 ± 2.03	20.18 ± 3.37	20.19 ± 2.32	22.45 ± 4.64	32.68 ± 3.08
A. sublessingiana (stems)	11.96 ± 3.27	11.99 ± 3.54	13.22 ± 3.68	14.31 ± 3.72	18.55 ± 3.19
A. sublessingiana (aerial part)	10.38 ± 4.17	10.08 ± 3.18	11.31 ± 3.69	11.98 ± 2.17	16.03 ± 2.04

Antiradical activity was determined by the literature method [14, 15]. The tested essential oils showed low antioxidant activity as compared to the standard (butylhydroxyanisole) (Table 2).

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REFERENCES

1. T. V. Ryakhovskaya, A. M. Manadilova, and O. A. Sapko, *Chem. Nat. Compd.*, **21**, 381 (1985).
2. V. A. Tarasov, Sh. Z. Kasymov, and G. P. Sidyakin, *Chem. Nat. Compd.*, **7**, 722 (1971).
3. R. I. Jalmakhanbetova, Ye. M. Suleimen, M. Oyama, E. B. Elkaeed, I. H. Eissa, R. N. Suleimen, A. M. Metwaly, and M. Yu. Ishmuratova, *J. Chem.*, Art. ID 5547013, 8 (2021).
4. Z. Sakipova, N. S. H. Wong, T. Bekezhanova, A. Sadykova, A. Shukirbekova, and F. Boylan, *PLoS ONE,* 12 (3), e0173714 (2017).
5. J. Jenis, A. Kurmanbayeva, Zh. Shynykul, Ye. Yang, and M. A. Dyusebaeva, *Int. J. Biol. Chem*., **11** (2), 117 (2018).
6. D. A. Sampietro, E. F. Lizarraga, Z. A. Ibatayev, A. B. Omarova, Y. M. Suleimen, and C. A. N. Catalan, *Nat. Prod. Res.,* **30**, 1950 (2016).
7. E. M. Suleimen, Z. A. Ibataev, Z. B. Iskakova, M. Y. Ishmuratova, S. A. Ross, and C. H. G. Martins, *Chem. Nat. Compd.*, **52**, 173 (2016).
8. E. M. Suleimen, G. G. Sisengalieva, A. A. Adilkhanova, R. V. Dudkin, P. G. Gorovoi, and Z. B. Iskakova, *Chem. Nat. Compd.*, **55**, 154 (2019).
9. *State Pharmacopoeia of the USSR*, No. 2, *General Methods of Analysis. Medicinal Plant Raw Material*, MH USSR, 11th Ed., Moscow, 1990, 400 pp.
10. H. G. Mierendorf, E. Stahl-Biskup, M. A. Posthumus, and T. A. van Beek, *Flavour Fragrance J.*, **18** (6), 510 (2003).
11. N. R. Andriamaharavo, Retention Data, NIST Mass Spectrometry Data Center, 2014.
12. E. M. Suleimen, Zh. A. Ibataev, Zh. B. Iskakova, and M. Yu. Ishmuratova, *Chem. Nat. Compd.*, **51**, 1184 (2015).
13. Ye. M. Suleimen, Zh. A. Ibatayev, Zh. B. Iskakova, M. Yu. Ishmuratova, and C. H. G. Martins, *Bull. Karaganda Univ. Chem. Ser.,* **1** (81), 8 (2016).
14. O. Sawant, V. J. Kadam, and R. Ghosh, *J. Herbal Med. Toxicol.,* **3** (2), 39 (2009).
15. M. A. Zhunusova, E. M. Suleimen, Zh. B. Iskakova, M. Yu. Ishmuratova, and R. M. Abdullabekova, *Chem. Nat. Compd.,* **53**, 775 (2017).