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CHEMICAL COMPOSITION OF THE ESSENTIAL OIL OF THE FLOVERING AERIAL PARTS OF PHLOMOIDES KAUFMANNIAN (REGEL) ADYLOV, KAMELIN & MAKHM.

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ABSTRACT

The composition of the essential oil obtained from the dried flowering aerial parts of Phlomoides kaufmanniana (Regel) Adylov, Kamelin & Makhm. (Lamiaceae) was analyzed by GC and GC-MS. Forty-two components have been identified in the essential oil of Phlomoides kaufmanniana. The major compounds of the essential oil were linalyl formate (12.25%), phenyl- acetaldehyde (10.78%), 2-octyldecane-1-ol (7.55%), tricosan (5.68%), 2,6,10-trimethyltridecan (4.30%), 1-butanol (3.92%), furfural (3.86%), cis-linalool oxide (furan) (3.57%), benzaldehyde (3.47%), phenylethanol (2.92%).

KEYWORDS: Phlomoides kaufmanniana (Regel) Adylov, Kamelin & Makhm. (Lamiaceae), essential oil composition, linalyl formate (12.25%), phenylacetaldehyde (10.78%), 2-octyldecane-1-ol (7.55%).

INTRODUCTION

The flora of Uzbekistan comprises 4344 species of which 238 belong to the *Lamiaceae* family.[1] *Phlomoides kaufmanniana* (Regel) Adylov, Kamelin & Makhm. (*Eremostachys kaufmaniana* Regel), fam. *Lamiaceae* - found in Turkestan, Nuratau, Zeravshan and Gissar ranges, Kugitang and Ziadin-Zirabulak mountains, where it grows on clayey, clayey-gravelly slopes in the lower and middle zones of the mountains.[2,3] Flavonoids,[3,4] phenylpropanoids,[3,5] phenolcarboxylic acids,[3] neolignans, iridoids,[3,6] higher fatty acids,[3] nitrogen-containing compounds, steroids, hydrocarbons, carotenoids, triterpenoids, dieterpenes, carbohydrates, ascorbic acid, trace elements [3,7] were isolated from various plant species of the genus *Phlomoides*.

The most well-studied species of the genus is *Ph. tuberosa*. It is used in folk medicine for pneumonia, bronchitis, jaundice, hemorrhoids as an astringent, wound-healing and tonic. Plant extracts have anti-inflammatory, hepatoprotective and choleretic properties.[3,6,8] A complex preparation containing flavonoids, iridoids, phenolcarboxylic acids with sedative, diuretic and cardiotonic effects has been proposed.[3] From the leaves of Ph. tuberosa isolated essential oil containing phytol, linalool, eugenol, caryofillen oxide and others.[9] At the same time, the chemical composition of *Ph. kaufmanniana* has not been practically studied and there is only a report on the isolation of lectins from its seeds.[10] The purpose of this work is to study the chemical composition of essential oil of *Ph. kaufmanniana*.

MATERIALS AND METHODS

Collection of plant material

The flowering aerial parts of *Ph. kaufmanniana* were collected in June 2018 from the foothills of the village Hayatsai, of Farish district in Jizzakh region of Uzbekistan and identified by researcher of the Institute of botany, Academy of Sciences of Uzbekistan I. Zh. Zhuramuradov. A voucher specimen was deposited at the Herbarium of the Institute of botany, Academy of Sciences of Uzbekistan.

Essential oil isolation

The oil of dried floweing parts of *Ph. kaufmanniana* (150 g) was isolated by hydrodistillation in Clevenger-type apparatus for 3 h. Essential oil from the distillate was isolated by liquid-liquid extraction with chloroform. The solvent was distilled and the essential oil was dried with anhydrous sodium sulfate and kept at 4°C in a sealed brown vial until the GC and GC-MS analyses. Received a light green with a yellowish tint oil with a yield of 3.85%.

Gas Chromatography-Mass Spectrometry Analysis

The qualitative and quantitative composition of the essential oil was determined on an Agilent 5975C inert MSD / 7890A GC chromatography-mass spectrometer. The components of the mixture were separated on an

Agilent HP-INNOWax quartz capillary column (30м×250µm×0.25µm) in the temperature regime: 50°C (1 min) - 4°C / min to 200°C (6 min) - 15 °C / min to 250°C (15 min). The volume of the introduced sample was 1.0 µl, the flow rate of the mobile phase (H_2) was 1.1 ml / min. EI-MS spectra were obtained in the m / z range of 10-550 a.m.u. The components were identified by comparing the characteristics of the mass spectra with the data of electronic libraries (Wiley Registry of Mass Spectral Data-9th Ed., NIST Mass Spectral Library, 2011), and comparing the retention indices (RI) of the compounds, determined with respect to the retention time of the mixture of n-alkanes (C9-C24). The percentage of each component was reported as raw percentage based on the total peak area.

RESULTS

The results of the GC-MS analysis of essential oil obtained from of air-dried floweing parts of *Ph. kaufmanniana* are presented in figure 1 and table 1.

The GC-MS analysis revealed that the essential oil contained 47 compounds (table 1), of which 42 were identified as hydrocarbons (17.85%), alcohols (17.44%), aldehydes (23.39%), oxygenated monoperpenam (18.58%), nitrogen-containing compounds (5.46). %), ketones (1.07%) and other classes.

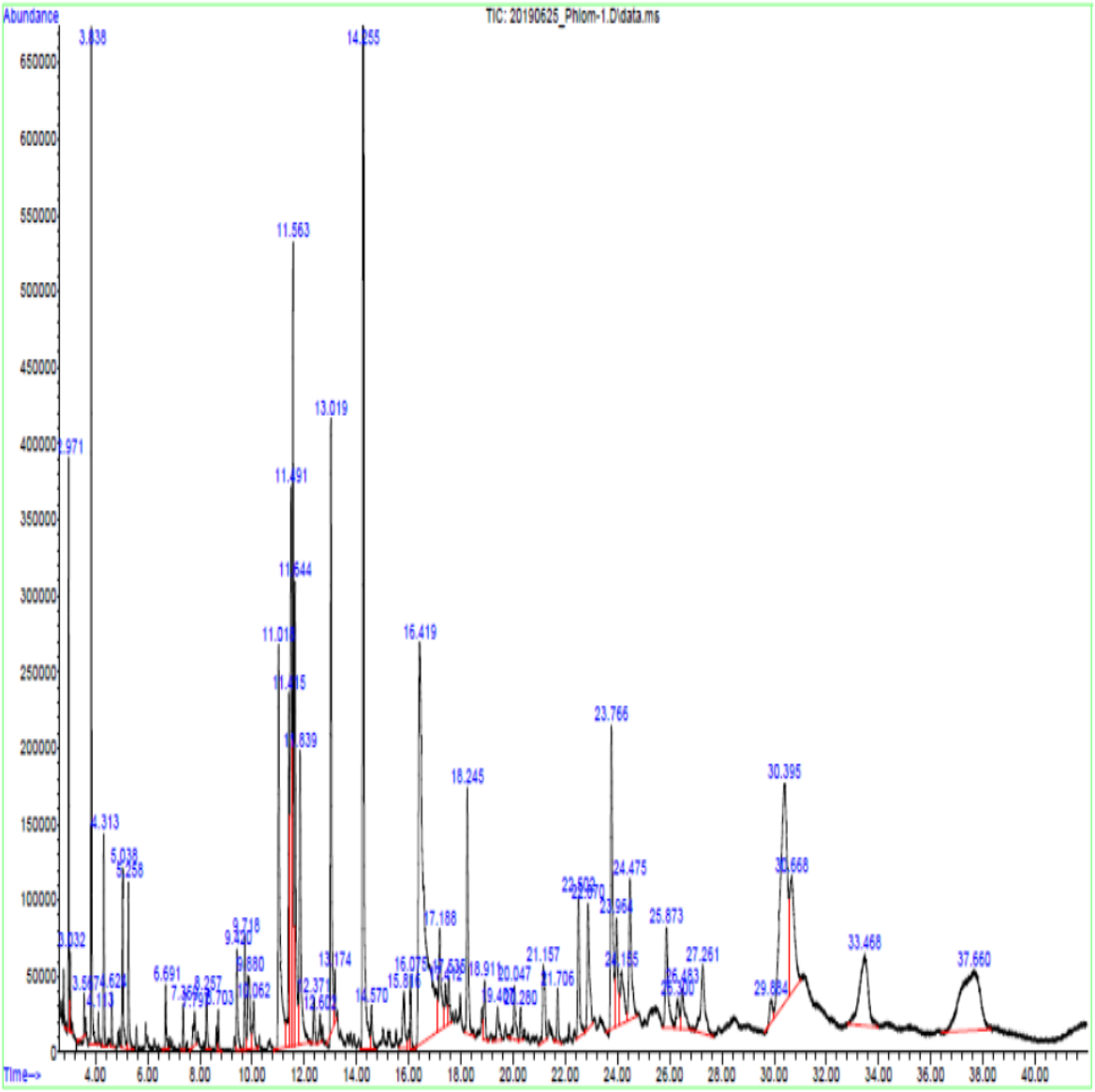

Figure 1: Chromatogram of essential oil composition of *Phlomoides kaufmanniana.*

The dominant components of the essential oil are linalyl formate (12.25%), (10.78%), 2-octyldecane-1-ol (7.55%), tricosan (5.68%), 2,6,10-trimethyltridecan (4.30%), 1-butanol (3.92%), furfural (3.86%), cis-linalool oxide (furan) (3.57%), benzaldehyde (3.47%), docosan (3.01%), phenyl ethanol (2.92%).

Table 1: Result of the GC-MS analysis of the essential oil *Ph. Kaufmanniana.*

Peak №	Compound name	Retention Time, min	Retention Index	Composition, %
1.	Hexanal	2.974	1075	1.43
2.	2-Methyl-1-propanol	3.029	1080	0.26
3.	trans-3-Penten-2-one	3.564	1116	0.01
4.	1-Butanol	3.835	1131	3.92
5.	3-Penten-2-ol	4.315	1156	0.85
6.	Heptanal	4.622	1173	0.20
7.	2-Methylbutanol	5.040	1196	1.01
8.	trans-2-Hexanal	5.261	1205	0.78
9.	3- Hydroxy-2-butanone	6.688	1260	0.32
10.	2,3-Dimethylpyrazine	8.256	1320	0.32
11.	4-Hydroxy-4-methyl-2-pentanone	8.705	1337	0.19
12.	trans-3-Hexenol	9.418	1364	0.59
13.	Nonanal	9.719	1376	0.59
14.	Trimethylpyrazine	9.879	1382	0.86
15.	cis-3-Hexen-1-ol	10.063	1389	0.44
16.	cis-Linalool oxide	11.017	1423	3.57
17.	Decanal	11.416	1437	1.95
18.	Furfural	11.490	1440	3.86
19.	2,6,10-Trimethyltridecane	11.564	1442	4.30
20.	Unidentified	11.644	1445	2.99
21.	2,3,5,6 Tetramethylpyrazine	11.840	1452	2.48
22.	(E,E)-2,4-Heptadienal	12.369	1470	0.33
23.	2,5-Hexanedione	12.603	1478	0.20
24.	Benzaldehyde	13.021	1493	3.47
25.	Pentadecane	13.175	1500	0.29
26.	Linalyl formate	14.257	1535	12.25
27.	4-Ethyl-4-methylcyclohex-2-enone	14.570	1546	0.35
28.	Hexadecane	16.077	1600	0.42
29.	Phenylacetaldehyde	16.421	1609	10.78
30.	Unidentified	17.190	1637	1.21
31.	α-Terpineol	18.247	1674	1.81
32.	Heptadecane	18.911	1700	0.52
33.	Methyl nicotinate	20.049	1740	0.52
34.	Citronellol	21.156	1780	0.95
35.	Octadecane	21.709	1800	0.40
36.	Unidentified	22.502	1829	1.26
37.	Benzyl allyl ether	22.871	1842	1.40
38.	Benzene ethanol	23.769	1874	2.92
39.	Benzyl nitrile	23.966	1882	1.28
40.	Nonadecane	24.476	1900	1.77
41.	Unidentified	25.872	1950	1.42
42.	Acetoxyacetic acid tridec-2-ynyl ester	26.480	1972	0.70
43.	Eicosane	27.261	2000	1.46
44.	2-Octyldecan-1-ol	30.397	2101	7.55
45.	Unidentified	30.668	2110	2.77
46.	Docosane	33.471	2200	3.01
47.	Tricosane	37.659	2300	5.68
	Total			95.64%

DISCUSSION

All identified compounds in *Ph. kaufmanniana* discovered for the first time. It should be noted that a rather high content (12.25%) of the essential oil of acyclic monoterpene linalyl formate, a fragrant substance with the smell of coriander used to make floral perfume compositions, as well as phenylacetaldehyde with an acute smell of greenery, hyacinth.[11] The latter is found in citrus, rose and other essential oils. Phenylacetaldehyde occurs extensively in nature because it can be biosynthetically derived from the amino acid phenylalanine. Natural sources of the compound include chocolate, buckwheat, flowers, and communication

pheromones from various insect orders. It is notable for being a floral attractant for numerous species of Lepidoptera; for example, it is the strongest floral attractor for the cabbage looper moth.[12] Cis-linalool oxide (furan) is the main component of honeysuckle and Lankaran acacia essential oil, also found in coriander, lavender, and lavender essential oils.[11] α-Terpeniol has a wide spectrum of pharma- cological activity: antioxidant, antitumor, anticonvulsant, antiulcer and antihypertensive.[13] Citronellol has analgesic, anticonvulsant, and antifungal properties; it is used to formulate perfumes and food essences.[14]

CONCLUSION

The essential oil of *Ph. Kaufmanniana* is rich in oxygenated monoperpenes (18.58%), aromatic aldehyds (23.39%), hydrocarbons (17.85%) and alcohols (17.44%). The major compound in the oil is linalyl formate (12.25%), phenylacetaldehyde (10.78%), 2-octyldecane-1-ol (7.55%), tricosan (5.68%), 2,6,10-trimethyltridecan (4.30%), 1-butanol (3.92%), furfural (3.86%), cis-linalool oxide (furan) (3.57%), benzaldehyde (3.47%), docosan (3.01%) and phenylethanol (2.92%).

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