



RESEARCH ARTICLE

Open Access

The phytochemical study of the *Pastinaca pimpinellifolia*

Pastinaca pimpinellifolia'nın fitokimyasal çalışması

Husniya Mammadova Gara^a

^a Department of Chemistry and Biology, Sumgait State University, Sumgait, Azerbaijan

Article Info

©2023 Ali Nihat Gökyiğit Botanical Garden Application and Research Center of Artvin Coruh University.

*Corresponding author:

e-mail:

husniyamammadova63@gmail.com

ORCID: 0000-0002-8936-9562

Article history

Received: April 28, 2024

Received in revised form: June 29, 2024

Accepted: June 29, 2024

Available online: June 30, 2024



This is an Open Access article under the CC BY NC ND license (<http://creativecommons.org/licenses/by/4.0/>).

Keywords: *Pastinaca pimpinellifolia*, natural compounds, peucenidin, oroselon, tomazin

Anahtar Kelimeler: *Pastinaca pimpinellifolia*, doğal ürünler, peucenidin, oroselon, tomazin

ABSTRACT

The *Pastinaca* genus belongs to *Umbelliferae* family. *Pastinaca pimpinellifolia* M.Bieb grows in the north-west (Gadabay region) of Azerbaijan. In the present study, phytochemicals of the plants have been isolated and their structures have been elucidated. The mix of extractive substances was obtained by finely cutting the body of *Pastinaca pimpinellifolia*, then drying in the room conditions (100 g) and extracting by 95% alcohol 3 times (3 days for each time). The alcohol was filtered and evaporated on a water bath. The residue was a brown resin (6 g, 3% yield). The resin (6 g) was dissolved in CHCl₃ (50 mL) and chromatographed over a column of neutral Al₂O₃ with elution by hexane, benzene, chloroform and alcohol, in different ratios. The volume of each fraction was 100 mL. The separation and isolation process was carried out using column (silica gel) and thin layer chromatographic (TLC) methods. Current research is devoted to studying the chemical composition of the wild plants *Pastinaca pimpinellifolia*. The alcohol extraction resulted in the procurement of three individual substances *peucenidin* 1,9% *oroselon* 2.3% and *tomazin* 2.7%.

Öz

Pastinaca cinsi, *Umbelliferae* familyasına aittir. *Pastinaca pimpinellifolia* M.Bieb, Azerbaycan'ın kuzeybatısında (Gadabay bölgesi) yetişmektedir. Bu çalışmada, bitkilerin fitokimyasalları izole edilmiş ve yapıları belirlenmiştir. *Pastinaca pimpinellifolia* gövdesi ince doğranarak, oda koşullarında kurutulmuş (100 g) ve %95 alkolle üç kez (her seferinde 3 gün) ekstrakte edilmiştir. Alkol filtrelenmiş ve su banyosunda buharlaştırılmıştır. Elde edilen kalıntı, kahverengi bir reçinedir (6 g, %3 verim). Reçine (6 g) CHCl₃ (50 ml) içinde çözülmüş ve nötr Al₂O₃ sütunu üzerinde heksan, benzen, kloroform ve alkol ile farklı oranlarda elüsyon yapılarak kromatografik olarak ayrılmıştır. Her bir fraksiyonun hacmi 100 mL idi. Ayırma ve izolasyon süreci, kolon (silika jel) ve ince tabaka kromatografisi (TLC) yöntemleri kullanılarak gerçekleştirilmiştir. Bu araştırma, yabani bitki *Pastinaca pimpinellifolia*'nın kimyasal bileşiminin incelenmesine yönelik olup, alkol ekstraksiyonu sonucunda üç bireysel madde, peucenidin %1,9, oroselon %2,3 ve tomazin %2,7 oranlarında elde edilmiştir.

Citation:

To cite this article: Mammadova Gara H (2024). The phytochemical study of the *Pastinaca pimpinellifolia*. *Turk J Biod* 7(1): 17-19. <https://doi.org/10.38059/biodiversity.1474921>

1. INTRODUCTION

Of the 15 species of the genus *Pastinaca* L. (Chimi) belonging to the family *Apiaceae* Lindl, distributed in Eurasia and the Caucasus, 4 species are known in Azerbaijan: *P. umbrosa*, *P. armena*, *P. pimpinellifolia*, *P. glandulosa*. In the flora of Azerbaijan, these species are found in the middle mountain range to the alpine zone, in forests and shrubs, meadows, arid slopes (Askerov, 2006; Ibadullayeva, 2004; Flora of Azerbaijan 1955; Mammadova et al., 2022).

According to the latest literature data, *P. pimpinellifolia* M.Bieb.; Fl. Taur.-Caucasus 1: 237 (1808) is distributed in Turkey, Azerbaijan, Georgia, and other regions of the Caucasus (Ahmet et al., 2014). In the flora of Azerbaijan, the species *P. pimpinellifolia* is found in meadow formations around the village of Keleman in the Gadabay region. This formation is very rich in species composition.

103 species of the genus *Pastinaca* registered in the Plant List, one of which is *P. pimpinellifolia* M.Bieb. is a

plant. *Apiaceae Lindl* species have an interesting coumarin composition (Adriana et al., 2009). According to the literature coumarin derivatives have been identified in more than 1626 plant species belonging to 134 genera and 568 genera in the world flora (Serkerov et al., 2017; Gebhardt et al., 2005). Current research is devoted to study the chemical composition of *P. umbrosa*.

2. MATERIALS AND METHODS

Surface parts of *P. pimpinellifolia* species collected in the flowering phase from the territory of Gadabay region were used as the object of research.

Column chromatography method was used to get the individual items. Thus, the sum of 6 g ingredients was chromatographed in the glass column (h=80; d=2.5 cm) filled with Al₂O₃ (neutral, with III-IV degrees of activity). The volume of each fraction was taken 100 ml. The column chromatography was eluated by Hexane (10 fractions), hexane+benzen (20 fractions), benzene (30 fractions), benzene+chloroform (25 fractions), chloroform (7 fractions) and chloroform+etanol (3 fractions).

The obtained substances were compared based on the ¹H and ¹³C NMR information provided in literature on the structure of the individual items. The individuality of the substances was defined using thin layer chromatography method (Silufol UV 254, solvent-benzol+xloroform 1:1), IR-spectrums were drawn in the Cary 630 FTIR Spectrometer. ¹H, ¹³C, ¹³C Dept 135, Dept 90 spectrums

Substances 1. *Peucenidin* (C₂₁H₂₂O₇)

Table 1. *Peucenidin* infrared spectroscopy (IR), ultraviolet (UV) and melting temperature (Serkerov et al., 2006)

IR-spectr, v, sm ⁻¹	UV-specter, nm (lgε)	Melting point, °C
(v, cm ⁻¹): 806, 847, 862, 937, 980, 1005, 1024, 1053, 1076, 1115, 1131, 1320, 1353, 1490, 1575, 1621, 1646, 1727, 1751, 3092.	λ _{max} 207 (lgε 5.12), 226 (lgε 4.12), 298 (lgε 3.77), 322 (lgε 4.68)	122,0-225,0°C

Mass-spectra, m/z (Icomp, %): 386 (15), 326 (12), 311 (13), 303 (8), 286 (22), 261 (9), 244 (28), 243 (15), 229 (40), 227 (32), 201 (24), 187 (22), 83 (100), 43 (25). ¹H NMR spectra (CDCl₃, δ, ppm, J/Hz): 1.61, 1.70 (both s, 3H, CH₃ at C-4'), 1.86, 2.11 (both s, 3H, CH₃ at C-5''), 2.02 (3H, s, CH₃C=O), 5.15 (1H, d, J=7.0, H-2'), 5.58 (1H, broad s, H-4''), 6.21 (1H, d, J=9.6, H-3), 6.82 (1H, d, J=8.5, H-6), 6.97 (1H, d, J=7.0, H-3'), 7.40 (1H, d, J=8.5, H-5), 7.61 (1H, d, J=9.6, H-4).

Substances 2. *Oroson* C₁₄H₁₀O₃

were registered in the Bruker 300 MHz spectrometer for the isotope ¹H with frequency 300 MHz and for the ¹³C isotope with 75 MHz frequency using DMSO-d₆ as a solvent.

Three crystalline substances (*peucenidin*, *oroselon*, *tomazin*) were obtained individually by chromatography in a glass column filled with neutral, grade III-IV activity Al₂O₃ from the total amount of extractives extracted from the surface part of the *P. pimpinellifolia* plant.

3. RESULTS AND DISCUSSIONS

Natural products have begun to gain popularity worldwide for designing new and safe drugs or food additives. In this sense, novel plant products or plant metabolites are today one of the wild plant's most interesting subjects in scientific explorations. Especially uninvestigated wild plants are considered as an important pool for new pharmaceuticals and bioactive food additives, often termed nutraceuticals.

Current research is devoted to studying the chemical composition of the wild plants *P. pimpinellifolia*.

The current study aimed to conduct a chemical passporting of plants of the *Apiaceae* family, focusing on the coumarin content of the above-ground part of the *Pastinaca pimpinellifolia*. The alcohol extraction resulted in the procurement of three individual substances (*peucenidin* 1.9% *oroselon* 2.3% and *tomazin* 2.7 %). The elution of the obtained substances was executed using column chromatography with Al₂O₃.

Table 2. *Oroselon* infrared spectroscopy (IR), ultraviolet (UV) and melting temperature (Serkerov, 2005)

IR-spectr, ν , cm^{-1}	UV-spectr, nm ($I_{g\epsilon}$)	Melting point, $^{\circ}\text{C}$
ν_{max} 761, 813, 832, 907, 1021, 1124, 1153, 1373, 1554, 1617, 1680	λ_{max} 230 ($I_{g\epsilon}$ 4,11), 259 ($I_{g\epsilon}$ 3,67), 300 ($I_{g\epsilon}$ 3,74), 363 nm ($I_{g\epsilon}$ 4,08)	268,0-272,0 $^{\circ}\text{C}$

Mass-spectra, m/z (Icomp, %): 226 (100), 198 (82), 183 (48), 171 (24), 155 (53), 141 (28), 115 (43), 101 (12), 75 (26), 63 (78). IR spectra (ν , cm^{-1}): 760, 812, 831, 907, 1020, 1123, 1154, 1374, 1553, 1617, 1680. ^1H NMR spectra (CDCl_3 , δ , ppm, J/Hz): 2.13 (3H, s, CH_3), 5.24 (1H, d, s, H-5'), 5.82 (1H, s, H-5'), 6.36 (1H, d, J=9.6, H-3), 6.96 (1H, s, H-3'), 7.30, 7.34 (both d, 1H, J=8.5, H-5,6), 7.77 (1H, d, J=9.6, H-4).

Substances 3. Tomazin (Edultin) $\text{C}_{21}\text{H}_{22}\text{O}_7$

Table 3. Tomazin infrared spectroscopy (IR), ultraviolet (UV) and melting temperature (Serkerov et al., 2006)

IR-spectr, ν , cm^{-1}	UV-spectr, nm ($I_{g\epsilon}$)	Melting point, $^{\circ}\text{C}$
ν_{max} 3484 (OH), 3137 (CH), 1716 (CO- δ -lactones), 1650, 1614, 1589	λ_{max} 207 ($I_{g\epsilon}$ 5.12), 232 ($I_{g\epsilon}$ 4.21), 300 ($I_{g\epsilon}$ 3,36), 318 nm ($I_{g\epsilon}$ 4.21)	154-156 $^{\circ}\text{C}$

Mass-spectra, m/z (Icomp, %): 386 (18), 311 (12), 287 (12), 261 (8), 243 (32), 227 (18), 187 (73), 83 (100), 43 (54). ^1H NMR spectra (CDCl_3 , δ , ppm, J/Hz): 1.59, 1.71 (both s, 3H, CH_3 at C-4'), 1.81, 1.92 (both s, 3H, CH_3 at C-2''' and C-3'''), 2.01 (3H, s, $\text{CH}_3\text{C}=\text{O}$), 5.28 (1H, d, J = 7.0, H-2'), 6.08 (1H, m, H-3'''), 6.23 (1H, d, J=9.6, H-3), 6.85 (1H, d, J=8.5, H-6), 7.02 (1H, d, J=7.0, H-3'), 7.41 (1H, d, J=8.5, H-5), 7.62 (1H, d, J=9.6, H-4).

Obtained 3 substances were peucenidin, oroselon, tomazin. The ^1H -NMR spectra were recorded at 300 MHz on a Bruker AM300 NMR spectrometer. The ^{13}C -NMR spectra were recorded at 75 MHz on the same instrument. Further investigation needed for the isolation of other phytochemicals and also an investigation of biological properties.

4. CONCLUSION

Three compounds were isolated for the first time from the extracts obtained from the aerial parts of *P. pimpinellifolia*. The structures of the isolated compounds were identified as *peucenidin*, *oroselon* and *tomazin* on the basis of spectroscopic and by comparing their physical properties reported in the literature.

REFERENCES

Adriana B, Sergio S (2009). Antimicrobial and antioxidant activities of coumarins from the Roots of *Ferulago campestris* (Apiaceae). *Molecules* 14(3): 939–952.
Ahmet D, Gizem B, Ertan T, İsmail Ş (2014). A review of edible plants on the Turkish Apiaceae species. *İstanbul Eczacılık Fakültesi Dergisi* 44(2): 251-262.

Askerov AM (2006). High plants of Azerbaijan. *Concept of the flora of Azerbaijan II* 2: 195.
Flora of Azerbaijan (1955). VI: 491-492.
Gebhardt Y, Witte S, Forkmann G, Lukacin R, Matern U, Martens S (2005). Molecular evolution of flavonoid dioxygenases in the family Apiaceae. *Phytochemistry* 66 1273–1284.
Ibadullayeva SC (2004). Apiaceae of the Azerbaijan flora. Publishing House "Elm", 347p.
Mammadova HG, Serkerov S.V (2022). Isolation and characterization of phytochemicals of *Pastinaca umbrosa*. *Chemistry of Plant Raw Materials* 3: 491-492.
Serkerov SV (2005). Terpenoids and phenolic plants of the Asteraceae and Apiaceae families 311p.
Serkerov SV, Aleskerova AN (2006). Infrared spectra and structure of sesquiterpene lactones and coumarins. *Institute of Botany Azerbaijan National Academy of Sciences* 233.
Serkerov SV, Qasumova GQ, Heydarov İG (2017). Furocoumarins with photosensitizing properties isolated from some plants of Apiaceae family of the Azerbaijan flora. *Transaction of the Institute of Botany of Azerbaijan NAS* 37: 38-44.