International Journal of Agriculture, Environment and Food Sciences
e-ISSN : 2618-5946
www.jaefs.com
JAEFS
edit PUBLISHING

Research Article
Int J Agric Environ Food Sci 6 (1): 130-134 (2022)

Essential oil content and chemical profile of *Cotinus coggygria* Scop. from Eastern Anatolia Türkiye

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Citation
Kocak, M.Z. and Yildirim, B. (2022). Essential oil content and chemical profile of Cotinus coggygria Scop. from Eastern Anatolia Türkiye. Journal of Agriculture, Environment and Food Sciences, 6 (1), 130-134.
Doi
https://doi.org/10.31015/jaefs.2022.1.17

Received: 09 January 2022
Accepted: 24 March 2022
Published Online: 28 March 2022
Revised: 02 April 2022

Year: 2022
Volume: 6
Issue: 1 (March)
Pages: 130-134

Available online
http://www.jaefs.com
https://dergipark.org.tr/jaefs

Abstract
The essential oil of the herb of the medicinal plant known as "smoke tree" (*Cotinus coggygria* Scop.) from Eastern, Anatolia (Turkey) was analyzed by Gas Chromatography-Mass Spectrometry (GC/MS). Twenty ingredients were identified for flowers representing 100% of the total oil while eleven ingredients were characterized in leaf essential oil comprising 99.96% of the oil extracted. As thymol (31.33%) and carvone (20.57%) were comprising main ingredients of the flower oil, the major ingredients of the leaf were determined as limonene and cis-ocimene by 48.53% and 23.57%, respectively. Identification of thymol form leaf sample as the predominant ingredient was first reported.

Keywords
Cotinus coggygria Scop., GC/MS, Essential oil, Thymol, Carvone

Introduction
Cotinus coggygria is one of the smallest genus of the *Anacardiaceae* family and is a species defined as a the "Smoke tree". In addition, the plant, which has a wide distribution area, stretches from the Mediterranean, Southern Europe, Moldova, the Himalayas and the Caucasus to Central China (Novakovic et al., 2007; Tunç et al., 2013; Banadkooki et al., 2019). It is frequent in some parts of Turkey mainly North, East and South biomes, called "Boyacı sumağı", "Sarı boya", "Sarı can" and "Sarı yaprak", locally (Bakış et al., 2011).

Generally, the plant is regarded as either wide shrubs or small tree, and has simple, oval leaves of yellow colour with a length of 3-8 cm, 18 cm thick. The flowers of the pentamerous plant, sometimes pale yellow or yellow-green, and abortive-hermaphrodite, long peduncle, in pole free blooming (da Silva et al., 2018; Pandourska et al., 2021; Shaboyan et al., 2021).

C. coggygria is a beneficial plant known for its medicinal activity, useful timber and landscape appeal. The young branches and leaves of the plant are used for the production of the aforementioned terpenic fragrant essential oil for use as perfumery in cosmetics (Gospodinova and Krasteva, 2017; Bahadırlı, 2020; Thapa et al., 2020; Sukhikh et al., 2021). It has also been used for resisting gastric, paradontosis, diarrhoea and duodenal ulcers (Ivanova et al., 2005). The extract of *C. coggygria*, which is beneficial for eye ailments, is also used in a cholagogue fever (Li, 2009). In addition, the dried leaves and other parts of *C. coggygria* are used as antipyretics in traditional Chinese medicine (Thapa et al., 2020; Sukhikh et al., 2021). In addition, *C.*

coggygria syrup protects the liver and most organs from chemical damage, affects the bile flow rate, and prevents inflammation, tumour, microbial infections and increases the immune system (Milosavljevic et al., 2021).

Prior phytochemical analysis of *Cotinus coggygria* identified showed almost having the same chemical composition with monoterpenic hydrocarbons predominant (Novakovic et al., 2007; Milosevic et al., 2008; Fraternale and Ricci, 2014; Sukhikh et al., 2021).

There have been studies on leaf essential oil of the plant in Türkiye (Demirci et al., 2003; Bahadırlı, 2020). However, this is the first report, to our knowledge, on inflorescence chemical profile on were collected from the naturally growing plants on the Sarikamis region of Kars, Turkey.

Materials and Methods

Plant Material

The fresh aerial parts of *Cotinus coggygria* Scop. were collected from the naturally growing plants in the Sarikamis region of Kars, Turkey in 2015. The plant materials were collected air-dried under shade, carefully separated into flowers and leaves, and kept for further analyses of the taxonomic identification of the collected plant materials was done by a plant taxonomist from the Department of Biology, Yuzuncu Yil University, Van, Türkiye.

Analysis of the Essential Oil

Drying 100 g of the plant sample in the Clevenger for 3 hours was subjected to hydrodistillation. The obtained oils were extracted with the help of distilled water and stored at 20 °C in an unopened bottle for later use. At the end of the analysis, the yields are based on the dry matter of the plant samples.

Gas Chromatography-Mass Spectrometry Analysis

The plant materials analyses were carried out on Shimadzu QP2010 brand model gas chromatography quadrupole-mass spectrometry system fitted with a TRB-WAX column (30 m × 0.25 mm film with 0.25 µm thickness). The carrier gas was helium with a linear velocity of 40 cm sec-1, the split ratio was 1:50 at a flow rate of 1.2 mL min-1. Primarily, oven temperature 60°C for 3 min and then programmed to raise from 60 to 240°C at 9°C min-1 and at last held isothermally for 5 min at 240 °C. The pre-processing took a total of 33 minutes injection and the ion source temperature in the device used was 240 °C. The injection volume was 1 µL in the 1/50 split mode (Devi et al., 2021). Masses were afflicted at 70 eV. The measured mass range was between 40 and 300 m/z. The contents of essential oils were defined by equal related retention times and mass spectra with authentic samples from essential oil library data (NIST 27, Wiley, 7 and NIST 147) and by comparing relative rate indices (RI) with published data.

Results and Discussion

The percentage of every identified compound in the leaf essential oil of *Cotinus coggygria* has given in Table 1, in which the ingredients are listed in accordance to with their retention indices. The GC/MS chromatogram of the essential oils has also appeared in Figure 1. The result analysis of a total of eleven compounds was characterized accounting for 99.96% of ingredients in the leaf oil samples. The total essential oil content for flower and leaf samples were 1.1% and 0.9%, respectively (Table 2).

The oil, characterized by the high amount of monoterpenes, was dominated by limonene (48.53%) and cis-ocimene (23.67%). The other major ingredients were cis-ocimene (7.22%), β- Phellandrene (5.62%) and α-pinene (3.72%). In the inflorescence oil, however, 21 ingredients were identified, representing 100% of the total oil. Thymol (31.33%) and carvone (20.57%) were found as the predominant ingredients. The essential oil was mainly characterized by sesquiterpene. The chromatogram profile of *C. coggygria* leaf oil has presented in Figure2.

As a result of some studies thirty-eight tables of contents from the category of monoterpenes and sesquiterpenes were described in the essential oils from the flowers of *Cotinus coggygria* from the South Serbia. In analysis, the main components in the essential oils were determined as monoterpene limonene (39.5%, 6.5% and 3.39%) and α-pinene (16.0, 15.1% and 21.9%) from leaves, flowers and stems has obtained (Milosevic et al., 2008).

Conclusion

In a study conducted on the same plant, in laboratory studies of wild *C. coggygria* plant from two regions in Serbia, such as Deliblatska pescara and Zemun, it was determined that monoterpenic hydrocarbons were prominent as 87.4% and 93.1%, respectively. As a result of the analysis, the main components of both extractions were limonene (47.0% and 39.2%), (Z)-β-ocimene (16.4% and 26.3%), α-pinene (8.2% and 8.4%), (E)-β-Osimene (4.6%) and 9.0% and terpinolene (6.8% and 5.3%) were found to be the same (Novakovic et al., 2007). Oil samples from Bulgaria contain basic components such as 8.5% α-terpineol, 43.0% α-pinene, 5.7% cymene, 2.4% globulol 11.4% β-pinene (Thapa et al., 2020). The main components of Hungarian oil samples were a-pinene 24.4–34.3%, δ-3-carene 4.6–11.0%, limonene 30.0–40.0%, β-pinene 7.6–20.2% and α-terpinolene 3.3–10.6% (Hethelyi et al., 1986). Similarly study ingredients of *C. coggygria* show that was 6.9% β-ocimene, 7.6% α- pinene (Rezaee et al., 2019). The essential oil composition of the flowers and leaves of *Cotinus coggygria* from Greece has previously been studied revealing limonene (67.4% and 41.4%) as the major constituent of both leaf and flower oil, respectively, where α-pinene was reported as the second main ingredient of either leaf (14.7%) or flower (32.4%) (Tzakou et al., 2005). GC/MS analysis of volatile oil of flowering aerial parts smoke wood from Italy revealed α-pinene (8.5%), (Z)-β-ocimene (15.2%), limonene (47.1%) and (E)-β-ocimene (5.3%) as the predominant ingredients (Fraternale and Ricci, 2014). While, camphene (8%), myrcene (50%), linalool, α-pinene (10%), and α-terpineol were described as the primary ingredients in the French *Cotinus coggygria* oil (Gildemeister and Hoffmann, 1959). The most predominant ingredients from Turkish smoke wood were determined as (E)-β-ocimene (9.7 %), (Z)-β-ocimene (27.9 %) and limonene (48.5 %) (Demirci et al., 2003). The unique finding of the current study was identification of thymol as the major constituent of leaf essential oil, which hadn't been observed in any of the previous research. Moreover, characterization of phytol

from diterpenes chemical class could be considered as the other novelty of the studied oil.

Table 1. Ingredient of the essential oils from *C. coggygria* Scop. aerial part.

Peak	Ingredient	RI	Flowers	Leaf
1	α-pinene	908	-	3.72
2	β-myrcene	941	-	0.77
3	Limonene	955	10.56	**48.53**
4	cis-ocimene	969	6.40	**23.67**
5	trans- β-ocimene	976	1.61	5.62
6	α- terpinolene	990	0.84	2.75
7	trans-caryophyllene	1090	0.79	2.31
8	trans-anethole	1093	-	3.47
9	α-amorphene	1108	0.54	-
10	α-terpinyl acetate	1112	0.47	-
11	β-bisabolene	1120	1.33	-
12	Geranyl acetate	1128	0.37	-
13	δ-cadinene	1130	1.27	-
14	Anethol	1148	11.55	-
15	trans-anethole	1151	2.34	-
16	Caryophyllene oxide	1189	0.38	0.84
17	Methyl eugenol	1193	1.23	-
18	Cedrenol	1221	2.62	-
19	Cedrol	1224	-	7.19
20	**Thymol**	1232	**31.33**	**-**
21	**Carvone**	1239	**20.57**	**-**
22	cis-asarone	1242	0.94	-
23	β-eudesmol	1245	0.79	-
24	Solvanol	1274	1.58	-
25	Phytol	1326	-	1.09
Total (%)			**100.00**	**99.96**
Essential oil content (%)			**1.1**	**0.9**

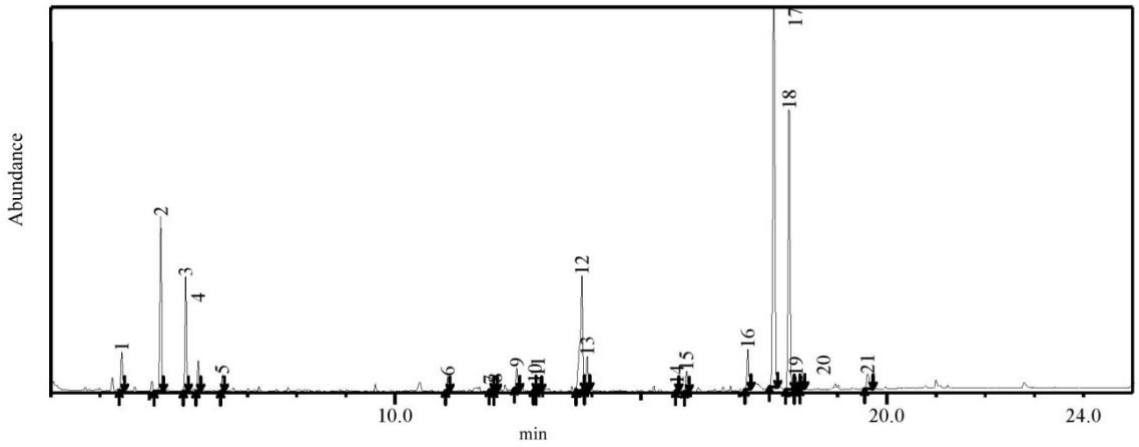

Figure 1. Chromatogram of *C. coggygria* Scop. flower.

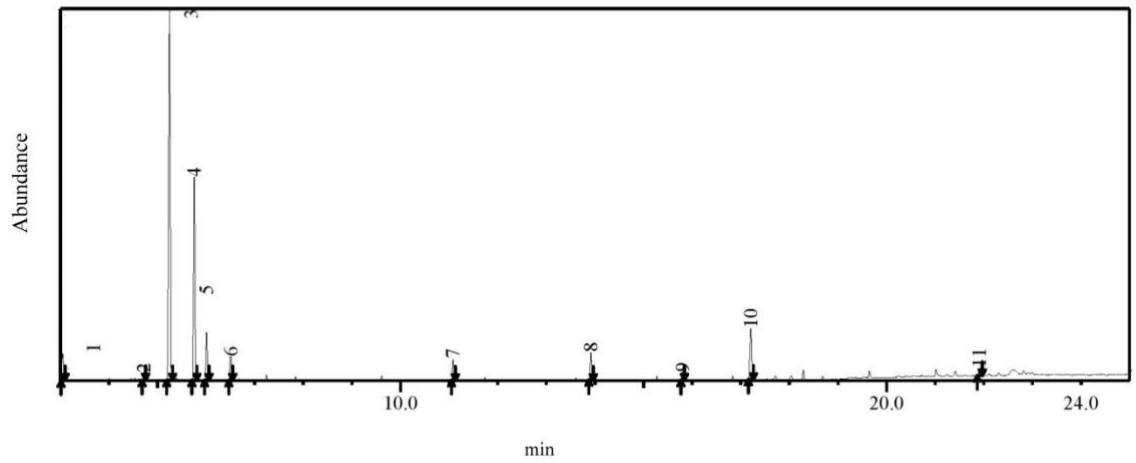

Figure 2. Chromatogram of *C. coggygria* Scop. leaf.

Compliance with Ethical Standards

Conflict of interest

The authors declared that for this research article, they have no actual, potential or perceived conflict of interest.

Author contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

Ethical approval

Ethics committee approval is not required.

Funding

No financial support was received for this study.

Data availability

Not applicable.

Consent for publication

Not applicable.

Acknowledgements

Grateful to the plant taxonomists from the Department of Biology, Van, Türkiye Yüzüncü Yıl University.

References

Bahadırlı, N.P. (2020). Essential oil content and composition of *Cotinus coggygria* Scop. from Hatay, Turkey. International Journal of Agriculture Forestry and Life Sciences, 4(1), 111-114.

Bakıs, Y., Babac, M.T., Uslu, E. (2011). Updates and improvements of (TÜBİVES) Turkish Plants Data Service. In proceedings of the 6 th international symposium on health informatics and bioinformatics (136-140) Ieee. Doi: https://doi.org/10.1109/HIBIT.2011.6450823

Banadkooki, A.M., Ardakani, M.D., Shirmardi, M., Momenpour, A. (2019). Effects of cow manure and vermicompost on growth characteristics of smoke tree (*Cotinus coggygria* Scop.) under salt stress under greenhouse. Iranian Journal of Forest and Poplar Research, 26(4). Doi: https://www.sid.ir/en/journal/ViewPaper.aspx?id=651904

da Silva, J.A.T., Pacholczak, A., Ilczuk, A. (2018). Smoke tree (*Cotinus coggygria* Scop.) propagation and biotechnology: A mini-review. South African Journal of Botany, 114, 232-240. Doi: https://doi.org/10.1016/j.sajb.2017.11.009

Devi, M. A., Sahoo, D., Singh, T. B., Rajashekar, Y. (2021). Antifungal activity and volatile organic compounds analysis of essential oils from Cymbopogon species using solid-phase microextraction-gas chromatography-mass spectrometry. Journal of Agriculture and Food Research, 3, 100110. Doi: https://doi.org/10.1016/j.jafr.2021.100110

Fraternale, D,. Ricci, D. (2014). Chemical composition and antimicrobial activity of the essential oil of *Cotinus coggygria* Scoop. From Italy. Journal of Essential Oil Bearing Plants 17(3), 366–370. Doi: https://doi.org/10.1080/0972060X.2014.895192

Ivanova, D., Gerova, D., Chervenkov, T., Yankova, T. (2005). Polyphenols and antioxidant capacity of Bulgarian medicinal plants. Journal of Ethnopharmacology, 96(1-2), 145-50. Doi: https://doi.org/10.1016/j.jep.2004.08.033Get

Gildemeister, E., Hoffmann, E. (1959). Die Aetherischen Öle, vol 5. Akademie Verlag. Berlin, Germany. Doi: https://doi.org/10.1007/978-3-7091-7159-2_4

Hethelyi, M.I., Domokos, J., Lemberkovics, E., Verzar-Petri, G. (1986). Analysis of the essential oil of *Cotinus coggygria* by means of mass spectrometry (GC/MS). Herba Hungarica, 25(1), 135–14

Li, T.S. (2016). Chinese and related North American herbs: phytopharmacology and therapeutic values. CRC press. Taylor & Francis Group, New York. Doi: https://doi.org/10.1201/9781420031881

Gospodinova, Z., Krasteva, M. (2017). *Cotinus coggygria* Scop. leaf extract exerts high but not dose-and time-dependent in vitro cytotoxic activity on human breast cancer cells. Genetics and Plant Physiology, 7(3-4), 176-183. Retrieved from http://www.ifrg-bg.com/

Milošević, T., Nićiforović, N., Mihailović, V., Solujić, S., Vuković, N. (2008). Chemical composition and antimicrobial activity of the essential oils of flowers, leaves and stems of *Cotinus coggygria*. Planta Medica 74(09), PI23. Doi: https://doi.org/10.1055/s-0028-1084931

Milosavljevic, S., Djordjevic, I., Mandic, B., Tesevic, V., Stankovic, M., Todorovic, N., Novakovic, M. (2021). Flavonoids of the Heartwood of *Cotinus coggygria* Scop. Showing protective effect on human lymphocyte DNA. Natural Product Communications, 16(12). Doi: https://doi.org/10.1177/1934578X211067289

Novakovic, M., Vuckovic, I., Janackovic, P., Sokovic, M., Filipovic, A., Tesevic, V., Milosavljevic, S. (2007). Chemical composition, antibacterial and antifungal activity of the essential oils of *Cotinus coggygria* from Serbia. Journal of the Serbian Chemical Society 72(11), 1045-1051. Doi: https://doi.org/10.2298/JSC0711045N

Pandourska, I.Y., Zhecheva, Y., Dimitrova, A., Mladenova, S., Kirilov, B. (2021). Anthropology And Anatomy 28 (4). Acta morphologica et anthropologica, 28, 3-4. Retrieved from http://www.iempam.bas.bg/journals/acta/acta_28b.pdf

Rezaee, M.B., Jaimand, K., Karimi, S. (2019). Study on chemical composition of essential oil in *Cotinus coggygria* Scop (Smoke Tree) from Iran. Journal of Medicinal plants and By-product, 8(1), 7-12. Doi: https://doi.org/10.22092/JMPB.2019.119376

Shaboyan, N.K., Moghrovyan, A.V., Dumanyan, K.H., Ghukasyan, N.H., Altunyan, A.A., Arshakyan, N.I., Chichoyan, N.B. (2021). Phytochemical analysis and antioxidant activity of *Cotinus coggygria* Scop. from Armenian Flora. Pharmacognosy Journal 13(4). Doi: https://doi.org/10.5530/pj.2021.13.120

Sukhikh, S., Noskova, S., Pungin, A., Ivanova, S., Skrypnik, L., Chupakhin, E., Babich, O. (2021). Study of the biologically active properties of medicinal plant *Cotinus coggygria*. Plants, 10(6), 1224. Doi: https://doi.org/10.3390/plants10061224

Thapa, P., Prakash, O., Rawat, A., Kumar, R., Srivastava, R.M., Rawat, D.S., Pant, A.K. (2020). Essential oil composition, antioxidant, anti-inflammatory, ınsect antifeedant and sprout suppressant activity in essential oil from aerial parts of *Cotinus coggygria* Scop. Journal of Essential Oil Bearing Plants, 23(1), 65-76. Doi: https://doi.org/10.1080/0972060X.2020.1729246

Tunç, K., Hos, A., Gunes, B. (2013). Investigation of antibacterial properties of *Cotinus coggygria* from Turkey. Polish Journal of Environmental Studies 22(5), 1559-1561. Retrieved from https://hdl.handle.net/20.500.12619/33302

Tzakou, O., Bazos, I., Yannitsaros, A. (2005). Essential oils of leaves, inflorescences and infructescences of spontaneous *Cotinus coggygria* Scop. from Greece. Flavour and Fragrance Jouranl 20(5), 531-533. https://doi.org/10.1002/ffj.1456