Essential Oil Composition of *Papaver rhoeas* L. (Corn poppy) (Papaveraceae) from Turkey

Türkiye'de Yetişen *Papaver rhoeas* L. (Gelincik) (Papaveraceae)'ın Uçucu Yağ Kompozisyonu

Research Article

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ABSTRACT

The genus *Papaver* is represented with the 50 taxa Turkey Flora, and it is the important genus in means of medicinal and aromatic plants. It has different type alkaloids. In the mediterranean, corn poppy greens are eaten as a vegetable. In this study, *Papaver rhoeas* L. was collected from the Elazig region and analysed chemically to determine the essential oil composition. The essential oil of the aerial parts obtained by hydrodistillation from *Papaver rhoeas* was investigated by GC and GC-MS. The essential oil yield is 0.2 % (v/w). Twenty one constituents were comprised the 98.6% of the total essential oil extracted from the plant. The predominant compounds of *Papaver rhoeas* were determined as phytol (52.8%), tricosane (7.8%), 2-pentadecanone (6%), heneicosane (5.3%). Consequently, sesquiterpene hydrocarbons were shown to be the main group of essential oil of the species.

Keywords
Papaver rhoeas, GC-MS, Essential Oil, Phytol.

ÖZET

Türkiye Florası'nda 50 taksonla temsil edilen Papaver cinsi tıbbi ve aromatik bir bitki olması bakımından önemli bir cinsdir. Farklı tipte alkoloidlere sahiptir. Akdeniz Bölgesi'nde gelinciğin yeşil kısımları sebze olarak yenir. Bu çalışmada Elazığ bölgesinden toplanan *Papaver rhoeas* L.'ın kimyasal analizlerle uçucu yağ kompozisyonu belirlenmiştir. *Papaver rhoeas*'ın su distilasyon yöntemi ile toprak üstü kısımlarından elde edilen uçu yağlar GC ve GC-MS'de incelenmiştir. Uçucu yağ verimi % 0.2 (v/w)'dir. Bitkiden elde edilen ekstrakta belirlenen 21 bileşen total yağın % 98.6'sını oluşturmaktadır. *Papaver rhoeas*'taki temel bileşenler fitol (52.8%), trikosan (7.8%), 2-pentadekanon (6%), heneikosan (5.3%) olarak belirlenmiştir. Sonuç olarak bu türün uçucu yağında seskiterpen hidrokarbonların ana grup olduğu görülmüştür.

Anahtar Kelimeler
Papaver rhoeas, GC-MS, Uçucu yağ, Fitol.

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INTRODUCTION

Papaver rhoeas L. (Papaveraceae) is an annual herbaceous plant, most commonly found in limestone soils [1] and in the wild in Europe [2]. Corn poppy (*P. rhoeas*) is the most important broad-leaved weed species infesting winter cereals in north-eastern Spain [3]. The pedicles, seeds and red petals of poppy can be used as food. While the pedicles are commonly used for salads, the red petals are used for the production of poppy sorbet in Turkey [4]. The poppy sorbet, like violet, rose and lily sorbet, is one of the traditional beverages in Turkey. The consumption of poppy sorbet, which was frequent in the past, has decreased and been replaced by fruit juice, in parallel with the advances in food industry [5]. The genus *Papaver* is represented with 50 taxa in Turkey flora, and it is the important genus in means of medicinal and aromatic plants. It has different type alkaloids. In the mediterranean, corn poppy greens are eaten as a vegetable. In addition to gastric complaints plant materials investigated are used in Turkish folk medicine for the some purposes; *P. rhoeas* roots used as antihelminthic [6]. Gurbuz et al., studied the anti-ulcerogenic activity of some plants used as folk remedy in Turkey, even the weakest anti-ulcerogenic effect observed for *P. rhoeas* roots was found statistically potent (95.6%) [7].

P. rhoeas is grassy plant with red flower and height 25-90 cm with growing in different parts of world including Iran. In Iranian folk medicine, the plant extract has been used for treatment of a wide range of diseases including inflammation, diarrhea, sleep disorders, treatment of cough, analgesia and also to reduce the withdrawal signs of opioid addiction. It is also claimed that *P. rhoeas* exhibits sedative, narcotic, and emollient effects [8].

The phytochemical investigation of *P. rhoeas* has previously shown the presence of alkaloids [9,10], such as rhoeadine, allotropine, protopine, coulteropine, berberine, coptisine, sinactine, isocorhydine, roemerine and rhoeagenine. Analytical studies using high performance liquid chromatography have also indicated the presence of isorhoeadine and rhoeagenine [11]. Non-alkaloidal secondary metabolites have been characterized by thin layer chromatography during the development of *P. rhoeas* flowers, including anthocyanins [12] with cyanidol as their major component [13]. Poppy flowers possess known pharmacological properties, and are used by humans for therapeutic purposes such as coughs, bronchitis, pneumonia, rash fever and for the symptomatic treatment of various neuronic states, particularly for minor sleep disorders in adults [14]. Its alkaloids are dopaminergic antagonists and neuroleptic [2].

P. rhoeas is a dicot weed infesting mainly cereals in Spain. In addition, several *P. rhoeas* biotypes resistant to acetolactate synthase (ALS) inhibitors have been described in Greece, Italy, and UK [15]. Currently, 27 weed species are known to be resistant to synthetic auxins worldwide [16]. The molecular basis of the resistance is unknown [17]. Coupland, reviewed resistance to auxin analogue herbicides, and concluded that in all cases evidence suggested that herbicide metabolism is significantly different in resistant compared with susceptible biotypes. The ways in which this detoxification occurs differs according to the species [18].

MATERIALS AND METHODS

Plant material

Papaver rhoeas L. was collected from natural habitats in Elazig (Turkey). Voucher specimens (FUH-9310) is kept at the Fırat University Herbarium (FUH), Elazig, Turkey.

Isolation of the essential oils

Air-dried aerial parts of the plant materials (100 g) were subjected to hydrodistillation using a Clevenger-type apparatus for 3 h.

Gas chromatographic (GC) analysis

The essential oil was analysed using HP 6890 GC equipped with FID detector and HP- 5 MS (30 m x 0.25 mm *i.d.,* film tickness 0.25 μm) capillary column was used. The column and analysis conditions were the same as in GC-MS expressed as below. The percentage composition of the essential oils was computed from GC-FID peak areas without correction factors.

Gas chromatography/mass spectrometry (GC-MS) analysis

The oils were analyzed by GC-MS, using a Hewlett Packard system. HP- Agilent 5973 N GC-MS system with 6890 GC in Plant Products and Biotechnology Res. Lab. (BUBAL) in Firat University. HP-5 MS column (30 m x 0.25 mm *i.d.,* film tickness 0.25 μm) was used with helium as the carrier gas. Injector temperature was 250°C, split flow was 1 mL/min. The GC oven temperature was kept at 70°C for 2 min. and programmed to 150°C at a rate of 10°C/min and then kept constant at 150°C for 15 min to 240°C at a rate of 5°C/min. Alkanes were used as reference points in the calculation of relative retention indices (RRI). MS were taken at 70 eV and a mass range of 35-425. Component identification was carried out using spectrometric electronic libraries (WILEY, NIST).

RESULTS AND DISCUSSION

The essential oil of the aerial parts of *P. rhoeas* collected from the Eastern Anatolian region of Turkey were obtained by hydrodistillation, in 0.2% (v/w) yield. The result of essential oils analysis are presented in Table 1. Overall, twenty one compounds which accounted for 98.6% in *P. rhoeas*. The predominant compounds of *P. rhoeas* were determined as phytol (52.8%), tricosane (7.8%), 2-pentadecanone (6%), heneicosane (5.3%).

Phytol is an acyclic diterpene alcohol that can be used as a precursor for the manufacture of synthetic forms of vitamin E and vitamin K1. The amount of free phytol in numerous food products has been reported. Phytol is used in the fragrance industry and used in cosmetics, shampoos, toilet soaps, household cleaners, and detergents [19].

Chemical studies have demonstrated the presence of rhoeadine, rhoeadic acid [9,10] papaveric acid [8], rhoeagenine [11] and anthocyanins as the major compounds of the extract of *P. rhoeas*. Rhoeadine is an alkaloid derived from the flowers of the corn poppy. It is used as mild sedative and mild antitussive [12].

Phenolic compounds are often related to the antioxidant activity of plants due to their ability to adsorb and/or neutralize free radicals by means of quenching unpaired oxygen radicals

Table 1. Constituents of the essential oil from *Papaver rhoeas* L.

No	Compounds	RRI	*P. rhoeas*
1	Benzene, 1,3-bis (3-phenoxy)	930	3.3
2	α-Pinene	1021	2.8
3	1,6-Octadien-3-ol, 3,7-dimethyl	1147	0.7
4	α-Terpineol	1215	0.5
5	2,6-Octadien-1-ol	1234	0.6
6	Isocaryophyllene	1385	3.4
7	Caryophyllene	1393	2.1
8	β- Ionene	1432	1.7
9	Germacrene D	1435	0.9
10	Bicylogermacrene	1444	0.7
11	Caryophyllene oxide	1498	0.8
12	Cylohexene-1-methyl-4	1543	0.5
13	2-Pentadecanone	1631	6
14	Nonadecane	1660	0.7
15	Farnesyl-acetone-C	1664	3.7
16	n-Hexadecanoic acid	1692	1.2
17	Heneicosane	1789	5.3
18	Phytol	1794	52.8
19	Tricosane	1902	7.8
20	Tetracosane	1948	1.5
21	1,15-Hexadecadiene	1961	0.9
TOTAL			98.6

RRI: Relative Retention Index

or compounds [20,21], therefore, polyphenols content of the extract may decrease oxidative damage on oocytes, when added to mat-uration media. Toustani et al., concluded that the supplementation of appropriate concentrations of *P. rhoeas* extract (50 μg/ml) in maturation medium improve the sheep oocyte maturation rate. Moreover, effects of *P. rhoeas* extract on oocyte maturation were dependent on the extract concentration in the maturation medium [22].

A lyophilized ethanolic aqueous extract of *P. rhoeas* petals was evaluated for its behavioral and pharmaco-toxicological effects in mice and its chemical composition was studied using thin layer chromatography (TLC). In the study, the chemical analysis by TLC showed that the petals contain some anthocyanins, whereas no alkaloids were detected. The toxicological effect of alcoholic and aqueous plant extract administered intraperitoneally was determined in mice [14].

In the study of one step green synthesis of silver nano/microparticles using extracts of *Trachyspermum ammi* and *P. somniferum* from India, the results showed that using same dosage of extracts the *T. ammi* was found to be superior to *P. somniferum*. Triangular shaped nanoparticles were observed using *T. ammi*, while almost spherical shaped particle with *P. somniferum* extract. The synthesis method presented in the article is unique on its own till date. The main constituents in *T. ammi* are thymol, p-cymene and γ-terpinene, while *P. somniferum* consists of morphine and codeine. The essential oil was found to be good reducing agent than the alkaloids in the formation of biocompatible silver nanoparticles (Ag-NPs) [23].

In many researches, antimicrobial properties of *P. macrostomum* Boiss. & Huet ex Boiss are determined. Three alkaloids including cheliantifoline, mecambrine, laudanosine, and two flavonoids luteoline and tricine of the *P. macrostomum* species have been shown to possess antimicrobial properties against most gram-positive and gram-negative bacteria. Some members of the Papaveraceae family from Turkish origin had antimicrobial activity against almost all bacteria that were tested [24]. In the study of Khanafari et al., the result showed that ethanol flower extract of *P. macrostomum* was more effective than others. It seems that there are more effective antimicrobial compounds in ethanol flower extract of *P. macrostomum* than the other parts. It is possible to said that the microbial effect, different extracts of poppy due to existence of morphine, thebaine, codeine, and oripavine are applied to produce sedative medicines [25].

The usability of this plant also is very common. The cationized natural dyeing of cotton fabrics with Corn Poppy (*P. rhoeas)* and investigation of antibacterial activity. Cotton fabrics were dyed with *P. rhoeas* flowers (petals) in company with four different mordant chemicals via pre-mordanting method. The effect of cationizing was investigated. Colorimetric properties, colour fastness (wash, alkali and acid perspiration, wet and dry rub and light fastness) values and antibacterial activity were determined after different process sequence combinations of cationizing, mordanting and dyeing. Different shades of green, brown, lead and tan colours were obtained on cotton fiber dyed with *P. rhoeas* flowers. Cationizing process increased the colour yield on both un-mordanted and mordanted samples [26].

Consequently, sesquiterpene hydrocarbons were shown to be the main group of essential oil of the species. No more study on the essential oil composition of the genus *Papaver* from Turkey and the world. The study showed that the *P. rhoeas* essential oil has phytol and tricosane chemotypes.

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