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Determination of Fatty Acid Composition of Seed and Tuber Oils of *Eminium rauwolffii* (Blume) Schott var. *rauwolffii*

Eminium rauwolffii (Blume) Schott var. rauwolffii'nin Tohum ve Tuber Yağlarının Yağ Asidi Bileşimlerinin Belirlenmesi

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Abstract

In this study, the *Eminium rauwolffii* (Blume) Schott var. *rauwolffii* taxon's tubers and seeds from Turkey were evaluated for their fatty acids. The seed and tuber oil content (%) and fatty acid compositions were determined. The oil contents of the seeds and tubers were 2.89/100 g and 0.86/100 g, respectively. Among the fatty acids for seeds, linoleic acid (18:2n6) was the most abundant (25.01%), followed by oleic acid (18:1n9, 14.45%), palmitoleic acid (16:1, 11.6%), and palmitic acid (16:0, 10.28%). In addition, among the fatty acids for tubers, linoleic acid (18:2n6c) was the most abundant (26.22%), followed by palmitic acid (23.42%, 16:0), oleic acid (16.78%, 18:1n9), and myristic acid (7.05%, 14:0). The total percentages of the saturated and unsaturated fatty acids identified in our examined oils were 14.17 and 55.89% for seed and 44.71 and 45.87% for tubers, respectively. In conclusion, the seed and tuber oil of *Eminium rauwolffii* (Blume) Schott var. *rauwolffii* is richer in unsaturated fatty acids compared with saturated fatty acids.

Keywords: Eminium, Fatty acids, Seed oil, Tuber oil

Öz

Bu çalışmada, Türkiye'den toplanan *Eminium rauwolffii* (Blume) Schott var. *rauwolffii* taksonunun tuber ve tohumları yağ asitleri açısından değerlendirilmiştir. Tohum ve tuberlerin yağ miktarları (%) ile yağ asitleri bileşimi belirlenmiştir. Tohum ve tuberlerin yağ miktarları sırasıyla 2.89/100 g ve 0.86/100 g olarak bulunmuştur. Tohum yağ asitleri arasında en fazla miktarda bulunan yağ asidili noleik asit (%25.01, 18:2n6), ardından sırasıyla oleik asit (%14.45, 18:1n9), palmitoleik asit (16:1, %11.6), ve palmitik asittir (16:0, %10.28). Ayrıca, tuber yağ asitleri arasında en fazla miktarda bulunan yağ asidinin linoleik asit (%26.22, 18:2n6), ardından sırasıyla palmitik asit (%23.42, 16:0), oleik asit (%16.78, 18:1n9), miristik asit (%7.05, 14:0) olduğu gözlenmiştir. İncelenen yağlar da tanımlanan doymuş ve doymamış yağ sitlerinin toplam yüzdeleri tohum için sırasıyla %14.17 ve %55.89 iken tuberler içinise sırasıyla %44.71 and %45.87'dir. Sonuç olarak, *Eminium rauwolffii* (Blume) Schott var. *rauwolffii* taksonunun tohum ve tuberlerindeki yağlarda doymamış yağ asitleri miktarının doymuş yağ asitleri miktarından daha fazla olduğu bulunmuştur.

Anahtar Kelimeler: Eminium, Yağ asitleri, Tohum yağı, Tuber yağı

1. Introduction

Eminium rauwolffii (Blume) Schott var. *rauwolffii* is a member of the Araceae family (commonly known as aroids). Araceae is a large, mainly tropical family, represented by about 117 genera and over 8,000 species throughout the world. In Turkey, there are 9 genera and 42 species of aroids. The genus *Eminium* (Araceae) is represented by six taxa in Turkey (Chen et al. 2007; Dring et al. 1995; Fırat et al. 2015; Yüce Babacan & Eker 2017).

Certain Araceae taxa have been widely used as cut flower plants and ornamentals, either as houseplants or glasshouse subjects (Chen et al. 2007; Dring et al. 1995). They have large usage areas; for instance, some are edible, some species can be cultivated to obtain feedstock for carbohydrate foods, and some are utilized in herbal medicines (Afifi& Abu-Dahab 2012; Agbor-Egbe& Rickard 1990; Chen et al. 2007; Coursey 1968; Gilani et al. 2006; Khare 2007; Lai et al. 2010; Obeidat 2011; Rajput et al. 2014; Sağlıket al. 2002a, 2002b; Si et al. 2010). Moreover, the *Eminium spiculatum* (Blume) Kuntze (Araceae) species is used as an anticancer agent (Afifi&Abu-Dahab, 2012), and the juice extract of

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the roots and tubers of *Typhonium flagelliforme* Araceae) are commonly employed for cancer treatment(Choo et al. 2001). *Typhonium divaricatum* has been used in Malaysia for many years to treat various types of malignancy; there is a widespread lay belief that this plant possesses anti-cancer properties (Neoh, 1992). In addition, the tubers, fruits, and seeds of *Dracunculus vulgaris* have long been used for thetreatment of rheumatism and hemorrhoids (Sağlık et al. 2002a).

In the literature, the composition of the fatty acid profile of some Araceae taxa has been determined. Sağlık et al. (2002a) studied the fatty acid composition of *Dracunculus vulgaris* and stated that the major fatty acids of seed oil are palmitic acid (16:0), palmitoleic acid (16:1n7), oleic acid (18:1n9), cis-vaccenic acid (18:1n7), linoleic acid (18:2n6), and 13-phenyl tridecanoic acids. The *Eminium lehmannii* leaves' and tubers' fatty acid compositions were determined by Chernenko et al. (2005). In their investigation, high concentrations of 18:3 acid were determined in neutral glycolipid and glycolipid from leaves, at 40.5 and 55.8%, respectively. Moreover, 16:0 (palmitic acid) was present in the phospholipid of leaves and tuber cores (38.3-42.9%, respectively). Chernenko and Glushenkova (2001) explored the lipids of the leaves, stems, and rhizomes with roots of *Acoruscalamus* L., and they found that the major fatty acids were the palmitic, oleic, and linoleic acids. Sağlık et al. (2002b) investigated the fatty acid content of *Arum italicum* (Araceae) seed oil and reported that the dominant fatty acids could be listed as palmitic acid (16:0), palmitoleic acid (16:1n7), stearic acid (18:0), oleic acid (18:1n9), linoleic acid (18:2n6), and 13-phenyltridecanoic acid.

Due to the importance of Araceae taxa, as mentioned above, their fatty acid contents have been investigated in the literature. However, unlike in the previous studies, the present investigation aims to contribute to the literature by exploring the fatty acid compositions of *Eminium rauwolffii* var. *rauwolffii* seeds and tubers from Turkey.

2. Materials and Methods

Eminium rauwolffii (Blume) Schott var. *rauwolffii* were used in this study. The samples were collected in May 2018 from the hills outside Buyukhan Village, Şanlıurfa in Turkey.

Oil Extraction

The fresh oil needed for fatty acid analysis was obtained via an automatic soxhlet device. Nine grams of seed and tuber samples were used for oil extraction. As solvent, hexane was employed. The oil contents of seeds and tubers were expressed in terms of how many grams of oil were contained in the 100g samples.

Determination of Fatty Acids

The fatty acids were analyzed via gas chromatography (GC; Perkin Elmer, Shelton, USA). Chromatographic separation was performed using a (30 m × 0.25 mm ID, 0.25-μm film thickness) column equipped with a flame ionization detector (FID). The oven temperature was 120 °C for 2 min, and then it was raised by 5°C/min to 220°C, which was held for 10 min; the injector and detector temperatures were set at 280 °C and 260°C, respectively. The results were expressed in GC area % as a mean value ± standard deviation.

3. Results and Discussion

The oil contents of the seeds and tubers are reported in Table 1.

The oil amount of the seeds and tubers were 2.89/100 g and 0.86/100 g, respectively (Table 1). The previous literature stated that 100 g of *Dracunculus vulgaris* (Araceae family taxon) seed samples contain 1.18 g of oil (Sağlık et al., 2002a), while 100 g of *Colocasia esculenta* var. *antiquorum* and *Xanthosoma sagittifolium* samples contain 2.8 g of total fat and 2.9 g of oil, respectively (Agbor-Egbe& Rickard 1990).

The results showed that the major fatty acids in *Eminium rauwolffii* var. *rauwolffii* seed oil were linoleic acid (18:2n6, 25.01%), oleic acid (14.45%, 18:1n9), palmitoleic acid (11.6%, 16:1), and palmitic acid (10.28%, 16:0; Table 1). Furthermore, the dominating fatty acids found in *Eminium rauwolffii* var. *rauwolffii* tubers oil were linoleic acid (18:2n6, 26.22%), palmitic acid (23.42%, 16:0), oleic acid (16.78%, 18:1n9), and myristic acid (7.05%, 14:0; Table 1). The results are similar to the findings of Chernenko et al. (2005), who found that the major fatty acids of *Eminium lehmannii* leaves, tuber casings, and [co]res were 16:0 (palmitic acid), 18:1, 18:2, and 18:3; Sağlık et al. (2002a, 2002b), who found that the major fatty acids of some Araceae family taxa were 16:0 (palmitic acid), 18:1n9 (oleic acid), and 18:2n6; and Opute and Osagie (1978), who found that the major fatty acids of *Alocasia macrorrhiza* and *Colocasia esculenta* were16:0 (palmitic acid), 18:0 (stearic acid), 18:1, 18:2, and 18:3. Unsaturated fatty acids in seeds and tubers were linoleic acid (C18:2n6), at 25.01% and 26.22%, respectively, followed by oleic acid (C18:1n9), at 14.45% and 16.78%, respectively (Table 1).

Table 1. Fatty acid composition and total oil content (%)

No	Compound	Fatty Acid	Seed (%)	Tuber (%)
	Oil content (g/100g)		2.89 g	0.86 g
1	C6:0	Caproic acid	ND	0.65 ±0.2
2	C8:0	Caprylic acid	ND	0.78 ±0.03
3	C10:0	Capric acid	ND	1.03 ±0.04
4	C12:0	Lauric acid	0.01 ±0.00	2.21 ±0.80
5	C14:0	Myristic acid	1.51 ±0.06	7.05 ±0.28
6	C15:0	Pentadecanoic acid	0.24 ±0.00	0.52 ±0.02
7	C16:0	Palmitic acid	10.28 ±0.41	23.42 ±0.93
8	C16:1	Palmitoleic acid	11.60 ±0.46	0.90 ±0.03
9	C17:0	Margaric acid	0.08 ±0.00	0.28 ±0.01
10	C18:0	Stearic acid	1.82 ±0.07	7.85 ±0.31
11	C18:1n9	Oleic acid	14.45 ±0.57	16.78 ±0.67
12	C18:2n6	Linoleic acid	25.01 ±1.00	26.22 ±1.04
13	C18:3n3	a-Linoleic acid	3.93 ±0.03	1.46 ±0.05
15	C20:0	Arachidic acid	0.14 ±0.00	0.33±0.01
16	C20:1	Gadoleic acid	0.12 ±0.00	ND
20	C22:0	Behenic	ND	0.37 ±0.01
23	C24:0	Lignoceric	0.09 ±0.00	0.22 ±0.00
	ΣSFA		14.17	44.71
	ΣMUFA		26.17	17.68
	ΣPUFA		28.94	27.68

SFA: Saturated fatty acids, **MUFA:** Monounsaturated fatty acids, **PUFA:** Polyunsaturated fatty acids, **ND:** Not detected

In light of their health benefits (Haag & Dippenaar 2005; Hu et al. 2001; Lichenstein 2006; Meydani et al. 1991; Moreno &Mitjavila 2003), percentages of both polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs) were investigated. The findings of the analysis showed that the total MUFA reached 26.17% in seeds, while this ratio was 17.68% in the tubers. As for the total PUFA ratios, they were found to be 28.94% and 27.68%, respectively. Two of the important groups of PUFAs in human nutrition are n-6 and n-3. The precursors of the n-6 and n-3 families of fatty acids are linoleic acid (18:2n6) and alpha-linolenic acid (18:3n3; an essential fatty acid that cannot be synthesized in the human body), respectively, and these PUFAs have to be supplied through the diet (Güney et al. 2015; Nair et al. 1997). The balance of n-6 and n-3 fatty acids is important for homeostasis and normal development (Simopoulos 1991). The n-3 fatty acids have significant roles in the modulation and prevention of human diseases, especially coronary heart disease (Connor 2000).

A low ratio of PUFAs to saturated fatty acids (SFAs; P/S ratio) is not healthy (Murkovic et al. 1996); when performing a nutritional evaluation, it is important to determine this ratio. In the present study, the P/S ratios were found to be 2.09% and 0.63% for seeds and tubers, respectively. Thus, the P/S ratio of tubers is lower than that of seeds. Among the saturated fatty acids (SFAs), palmitic acid (C16:0) showed the highest proportions, with 10.28% and 23.42% in seeds and tubers, respectively, followed by stearic acid, at 1.82% and 7.85%, respectively (Table 1).

4. Conclusion

In this study, the *Eminium rauwolffii* (Blume) Schott var. *rauwolffii* taxon's tubers and seeds were evaluated for their fatty acid composition and total oil content using Turkish samples; such work has not been done in previous research. As a result, PUFAs were detected in higher amounts than MUFAs and SFAs were in seeds. However, SFAs were more abundant in tubers, followed by PUFAs and MUFAs.

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