CHEMICAL COMPOSITION AND ANTIFUNGAL ACTIVITY OF *Origanum heracleoticum* ESSENTIAL OIL

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Origanum heracleoticum L. (syn. *O. hirtum* L.; *O. creticum* Sieber & Bentham; *O. vulgare* L. subsp. *hirtum* (Link) Ietswaart) (Lamiaceae) is native to Mediterranean Europe from Spain to northern Balkan and Asia. The essential oil, rich in phenols, is mainly used in the pharmaceutical and food industries [1, 2]. The essential oil is applied in aromatherapy for asthma, bronchitis, rheumatism, and digestive problems. It has been shown that this oil possesses cytotoxic and antioxidant activity [3]. In this work the essential oil of *O. heracleoticum* was tested for antifungal activity using standard procedures [4–7].

The results of chemical analysis of *Origanum heracleoticum* essential oil are presented in Table 1. Twenty-four compounds, which represent 97.16% of total oil, were identified. The main compound was carvacrol (65.25%), followed by thymol (14.84%) and β-phellandrene (4.36%) (Table 1). Phenols, thymol, and carvacrol were also dominant compounds in *O. vulgare* L. ssp. *hirtum* oil analyzed by other authors [8, 9].

Minimum inhibitory and fungicidal concentrations (MIC and MFC) of *O. heracleoticum* essential oil are presented in Table 2. The essential oil exhibited fungicidal characteristics with MIC and MFC of 0.1–1 μL/mL. *C. fulvum, C. cladosporioides P. helianthi*, *P. magdonaldii,* and *Trichophyton mentagraphytes* were the most susceptible fungi, while the most resistant were *T. viride, F. sporotrichoides*, *Penicillium,* and *Aspergillus* species.

TABLE 1. Chemical Composition (Expressed as %) of *Origanum heracleoticum* Essential Oil

Component	KI	%	Component	KI	%
α-Thujene	931	1.45	Terpinen-4-ol	1177	0.58
Octen-3-ol	978	0.57	α-Terpineol	1189	0.18
β-Myrcene	991	0.58	Carvacrol methyl ether	1244	0.24
α-Phelandrene	1005	0.34	Thymol	1290	**14.84**
α-Terpinene	1017	1.23	Carvacrol	1299	**65.25**
p-Cymene	1025	1.88	Isocaryophyllene	1404	1.45
β-Phellandrene	1030	4.36	α-Humulene	1454	0.24
γ-Terpinene	1060	0.65	Germacrene D	1480	0.07
α-Terpinolene	1089	0.23	β-Bisabolene	1506	0.52
Linalool	1098	0.63	δ-Cadinene	1523	0.20
α-Thujone	1102	0.61	Caryophyllene oxide	1583	0.08
Camphor	1146	0.44	Total		97.16
Borneol	1165	0.45			

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TABLE 2. Antifungal Activity of *Origanum heracleoticum* Essential Oil, μL/mL

Fungi	*O. heracleoticum*		*Bifonazole*		Fungi	*O. heracleoticum*		*Bifonazole*	
	MIC	MFC	MIC	MFC		MIC	MFC	MIC	MFC
Alternaria alternata	0.25	0.25	10	10	*Fusarium sporotrichoides*	1	1	15	20
Aspergillus niger	0.25	0.5	10	10	*Mucor mucedo*	0.1	0.25	15	15
Aspergillus ochraceus	1	1	10	15	*Penicillium funiculosum*	0.5	1	15	20
Aspergillus flavus	1	1	10	15	*Penicilium ochrochloron*	1	1	15	20
Aspergillus terreus	1	1	10	15	*Phomopsis helianthi*	0.1	0.1	10	10
Aspergillus versicolor	0.25	0.25	10	10	*Phoma magdonaldii*	0.1	0.1	10	15
Aureobasidium pullulans	0.25	0.25	5	10	*Trichoderma viride*	1	1	15	20
Cladosporium cladosporioides	0.1	0.1	10	10	*Trichophyton mentagrophytes*	0.1	0.1	10	15
Cladosporium fulvum	0.1	0.1	5	10	*Candida albicans*	0.25	0.25	10	15
Fusarium tricinctum	0.5	0.5	15	20					

Previous results indicate that the antimicrobial activity of essential oils is affected by their composition. Our study confirmed the antifungal activity of *Origanum heracleoticum* essential oil. The publication by Adam et al. showed that *O. vulgare* L. ssp. *hirtum* essential oil was lethal on *Trichophyton* and fungistatic on yeast *Malassezia furfur*. The high antifungal effect was atributed to the high amount of thymol and carvacrol [9]. Oregano essential oil was effective against bacterial strains due to phenols [10]. There is a high possibility that compounds with the phenol structure such as carvacrol and thymol are responsible for the antifungal activity of the oil.

REFERENCES

1. J. Lawless, *The Encyclopaedia of Essential Oils*. Thorsons, London (2002).
2. C. Leto, A. Salamone, Proceedings of the IPGRI International Workshop on Oregano 8–12 May, 1996. CIHEAM, Valenzano (Bary), Italy, ed. S. Padulosi, 1996, pp. 68–76.
3. A. Sivropolou, E. Papanikolaou, C. Nikolaou, S. Kokkini, T. Lanaras, and M. Arsenakis, *J. Agric. Food Chem.*, **44**, 1202 (1996).
4. R. Adams, *Identification of Essential Oil Components by Gas Chgromatography/Mass Spectroscopy*. Allured Publishing, Carol Stream, IL (2001).
5. C. Booth, *Fungal Culture Media*, in: *Methods in Microbiology,* eds. J. R. Norris, D. W. Ribbons, Academic Press, London– New York (1971), pp. 49–94.
6. H. Hanel and W. Raether, *Mycoses*, **31**, 148 (1988).
7. K. D. Daouk, M. S. Dagher, and J. E. Sattout, *J. Food Protect.*, **58**, 1147 (1995).
8. S. Kokkini, D. Vokou, and R. Karousou, *Bot. Chron.*, **10**, 337 (1991).
9. K. Adam, A. Sivropoulou, S. Kokkini, T. Lanaras, and M. Arsenakis, *J. Agric. Food Chem.*, **46**, 1739 (1998).
10. M. Marino, C. Bersani, and G. Comi, *Int. J. Food Mycrobiol.,* **67**, 185 (2001).