

ANTIMICROBIAL ESSENTIAL OIL FROM *Smyrniopsis aucheri*

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Smyrniopsis aucheri Boiss. (Apiaceae) is a wild growing perennial plant, monocarpic, robust, with a thick and resinifer root distributed in Anatoly, Iraq, Iran, and S. Transcaucasia regions [1, 2].

Coumarins including nachsmyrin, smyrniorin, smyrnioridin, smyrinol, smyrindiol, and smyrindiolside were reported from *S. aucheri* [3–6]. To our knowledge, there are no reports on the volatile chemical constituents and biological activities of this species. This study was therefore undertaken to investigate the composition and antimicrobial property of the essential oil of *S. aucheri*.

The volatiles from *S. aucheri* fruits were studied by GC-MS. Thirty-one components were identified (Table 1), representing 93.14 % of the total oil. Yield of the oil was 1.0 % (v/dry weight). The major components were α -bisabolol (19.91%), α -pinene (15.10%), and β -pinene (6.58%). α -Pinene and/or β -pinene have been reported as the major components of the fruit oil of some Apiaceae species, e.g., *Ammodaucus leucotrichus* subsp. *nanocarpus* [7], *L. macrocarpum* and *L. utriculatum* [8], *Smyrniium olusatrum* [9], *Ferula gummosa* [10], and *Peucedanum petiolare* [11], and may have some chemotaxonomic applications. α -Bisabolol is a sesquiterpene alcohol found in the oils of chamomile (*Matricaria chamomilla*) and other plants. It has been widely used in dermatological and cosmetic formulations. Owing to the pleasant floral-sweet odor and apparent harmlessness, it has been widely used as ingredients of dermatological and cosmetic preparations such as after-shave formulations, hand- and body lotions, underarm deodorants, lipsticks, sun-care and after-sun products, baby and elderly people-care products, and sport-creams [12]. According to the level of α -bisabolol in *S. aucheri* oil, fruits may be a source of this sesquiterpene.

Gram-positive bacteria, fungi, and *Pseudomonas aeruginosa* were sensitive to the essential oil of *S. aucheri* (Table 2). *Staphylococcus epidermidis* may be a pathogen in the hospital environment. *Staphylococcus aureus* causes food poisoning by releasing enterotoxins into food, and toxic shock syndrome by release of superantigens into the blood stream. *S. aureus* causes a variety of suppurative infections and toxinoses in humans [13]. *Bacillus subtilis*, a pathogen of animals, was sensitive to the oil. The oil was not found to be active *in vitro* against the specific strain of *Escherichia coil* or *Salmonella typhi*. *Pseudomonas aeruginosa* causes urinary tract infections, respiratory system infections, dermatitis, soft tissue infections, bacteremia, bone and joint infections, gastrointestinal infections, and a variety of systemic infections, particularly in patients with severe burns and in cancer and AIDS patients who are immunosuppressed.

P. aeruginosa infection is a serious problem in patients hospitalized with cancer, cystic fibrosis, and burns. The case fatality rate in these patients is 50 percent [13]. Among the Gram-negative bacteria examined, *Pseudomonas* consistently showed high or often highest resistance to antimicrobial essential oils [14], while this study showed that it is sensitive to *S. aucheri* oil. Infections due to *Candida* species are the most common of the fungal infections. *Candida* species produce a broad range of infections, ranging from non-life-threatening mucocutaneous illnesses to invasive process that may involve virtually any organ [15]. The oil examined showed strong candidacidal activity (Table 2). The antibacterial and antifungal effects may be due to the high level of α -bisabolol and α -pinene in the essential oil [16]. Based on the high α -bisabolol, α -pinene, and β -pinene content (41.59%) and marked antimicrobial activity of the oil, *S. aucheri* fruits can be studied as a new medicinal plant.

Plant Material. *S. aucheri* fruits were collected from plants growing wild in Daran, 40 km to Tiran, Gord-e Olia, Tcheshmeh Tangeh, in an altitude of 2500 to 2700 m, Isfahan, Iran, on July 30, 2001 and identified by I. Mehregan. A voucher specimen is deposited in the Herbarium of the Shiraz Faculty of Pharmacy.

Antimicrobial Assay. *In vitro* antimicrobial activities were determined by the agar disc diffusion method [17].

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TABLE 1. Chemical Constituents of *Smyrniopsis aucheri* Essential Oil [18]

Compound	RI ^a	Percentage ^b	Compound	RI ^a	Percentage ^b
Unknown	825	0.95	β -Chamigrene	1474	0.71
Unknown	860	1.65	Germacrene D	1478	0.97
Nonane	900	3.22	Bicyclogermacrene	1493	1.72
α -Pinene	936	15.10	<i>trans</i> - β -Guaiene	1497	0.59
Verbenene	956	0.65	Cubebol	1518	1.10
β -Pinene	977	6.58	γ -Cadinene	1522	4.06
Myrcene	992	1.50	Unknown	1563	1.12
Camphenone <6->	1095	3.21	Spathulenol	1576	2.62
<i>cis</i> -Verbenol	1151	4.34	Guaiol	1597	2.64
Pinocarvone	1163	0.73	δ -Eudesmol<10-epi>	1616	0.67
<i>p</i> -Mentha-1,5-dien-8-ol	1171	3.10	Selin-11-en-4-a-ol	1623	2.59
Verbenone	1209	0.67	Unknown	1645	0.73
Fenchyl acetate <endo>	1220	0.74	α -Bisabolol	1655	19.91
Bornyl acetate	1283	0.92	Unknown	1840	0.60
Unknown	1336	0.79	Dibutyl phthalate	1963	5.11
α -Copaene	1374	1.95	Identification		93.14
β -Bourbonene	1382	2.89	Grouped components		
β -Cubebene	1388	0.81	Monoterpene hydrocarbons		23.83
β -Elemene	1390	0.86	Oxygen-containing monoterpenes		13.71
β -Caryophyllene	1416	1.30	Sesquiterpene hydrocarbons		18.84
Unknown	1426	1.02	Oxygen-containing sesquiterpenes		28.43
β -Cedrene	1433	1.25	Others		8.33
<i>cis</i> -Thujopsene	1446	0.63			

^aThe retention index of the compounds on HP-5MS column was determined. ^bPercentages were calculated based on the concentration obtained on the same column.

TABLE 2. Antimicrobial Activity of *Smyrniopsis aucheri*

Microorganism	Inhibition zone ^a				
	3 μ L ^b	4 μ L	5 μ L	6 μ L	7 μ L
<i>Staphylococcus aureus</i> PTCC 1112*	++	+++	+++	+++	+++
<i>Staphylococcus epidermidis</i> PTCC 1114*	++	++	++	++	+++
<i>Bacillus subtilis</i> PTCC 1023*	+++	++++	++++	++++	++++
<i>Escherichia coil</i> PTCC 1338**	-	-	-	-	-
<i>Salmonella typhi</i> PTCC 1609**	-	-	-	-	-
<i>Pseudomonas aeruginosa</i> PTCC 1074**	+++	+++	++++	++++	++++
<i>Candida albicans</i> ATCC 14053***	+++	+++	+++	++++	++++
<i>Candida kefyri</i> ATCC 38296****	+++	+++	++++	++++	++++

^a++: 5-9 mm, +++: 10-14 mm, ++++: >14 mm. ^b Microliters of the essential oil were applied to the discs.

*Ampicillin: +++++; **Gentamicin: +++; ***Nystatin: +++; ****Nystatin: ++++.

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