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PHYTOCHEMICAL ANALYSIS OF SOME SIDERITIS SPECIES OF TURKEY

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Linearol, foliol, epicandicandiol, siderol and ent-7α,18-dihydroxy-15β,16β-epoxykaurane have been investigated for antibacterial activity test. Highest activity of epicandicandiol has been determined against E-coli.

Key words: Sideritis athoa, Sideritis trojana, Sideritis dichotoma, Sideritis Spilyea, Sideritis Argyrea, diterpenes, antibacterial activity.

Herbal parts of *Sideritis athoa, Sideritis trojana, Sideritis dichotoma, Sideritis Spilyea,* and *Sideritis Argyrea* which grow in the Balikesir region were investigated for their chemistry and biological activity. Dried aerial parts of the plants collected during flowering were successively extracted with hexane, acetone, and methanol. Diterpenes were isolated and characterized from the extracts using choromato-spectral techniques. As a result 41 diterpenoids were isoleted from the five *Sideritis* species studied, corresponding to 27 single structures belonging to kaurene (**1–24**), beyerene (**25**), pimarene (**26**), and labdane (**27**) skeletons including the following five new kaurene diterpenes: *ent*-3β,7α-dihydroxykaur-16-ene (**4**), *ent*-7α,17,18-trihydroxykaur-9,(11)-en-12-one (Athonolone) (**9**) from *Sideritis athoa*, *ent*-7α-acetoxy-15β,16β-epoxykaurane (**16**), 2α-hydroxy-8(14),15-pimaradiene (**26**) from *Sideritis trojana,* and *ent*-6β,8α- dihydroxylabda-13(16),14-diene (**27**) from *Sideritis Argyrea* (Table 1). Furthermore, linearol (**1**), foliol (**2**), 7-epicandicandiol (**6**), siderol (**10**), and *ent*-7α,18-dihydroxy-15β,16β-epoxykaurane (**20**) compounds were used for antibacterial activity test [1–19].

Linearol (**1**), foliol (**2**), 7-epicandicandiol (**6**), siderol (**10**), and *ent*-7a,18-dihydroxy-15β,16β-epoxykaurane (**20**) compounds were used for antibacterial activity test. First, as a qualitative criterion, inhibition zones were characterized by the disc diffusion method for diterpenic compounds, and for inhibition zones greater than 7 mm, "tube dilution tests" were performed quantitatively. *Bacillus subtilis, Staphylococcus aureus, Staphylococcus epidermidis, Proteus mirabilis, Escherichia coli, Enterococcus faecalis,* and *candida albicans* were investigated, and MIC (minimum inhibitory concentration) values were found (Table 2). As a result, the highest activity from 7-epicandicandiol was observed against *E. coli*. In addition, the same compound was active against *S. aureus, P. aeruginosa, K. pneumoniae,* and *E. faecalis. Ent*-7α,18-dihydroxy-15β,16β-epoxykaurane (**20**) was moderately active against *B. subtilis.*

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TABLE 1. Isolated Diterpenes

No.	Isolated Compound	*S. athoa*	*S. trojana*	*S. dichotoma*	*S. sipylea*	*S. Argyrea*
	Kauren Diterpenes					
1.	Linearol	+	-	-	+	+
2.	Foliol	+	-	-	-	+
3.	Sidol	+	-	-	-	+
4.	Ent-3β,7α-dihydroxykaur-16-ene	+	-	-	-	-
5.	Ent-3α,18-dihydroxykaur-16-ene	+	-	-	-	-
6.	7-Epicandicandiol	+	+	-	+	+
7.	7-Epicandicandiol 18 monoacetate	-	-	-	-	+
8.	Ent-3β-hydroxykaur-16-ene	+	-	-		
9.	Ent-7α,17,18-trihydroxykaur-9,(11)-en-12-one (Athonolone)	+	-	-	-	-
10.	Siderol	-	+	+	+	+
11.	Sideridiol	-	+	+	+	+
12.	Candol B	-	-	-	-	+
13.	Isocandol B	-	+	-	-	-
14.	Candol A acetate	-	+	-	-	-
15.	Ent-7α-acetoxykaur-15-ene	-	+	-	-	-
16.	Ent-7α-acetoxy-15β,16β-epoxykaurane	-	+	-	-	-
17.	Ent-7α-acetoxy-18-hydroxykaur-16-ene	-	-	-	-	+
18.	Ent-7β,15α,18-trihydroxykaur-16-ene	-	-	+	-	-
19.	Ent-7β-acetoxy-15α,18-trihydroxykaur-16-ene	-	-	+	-	-
20.	Ent-7α,18-dihydroxy-15β,16β-epoxykaurane	-	-	+	-	-
21.	Ent-7α-acetoxy-18-hydroxy-15β,16β-epoxykaurane	-	-	+	-	-
22.	Isolinearol	-	-	-	+	-
23.	Isosidol	-	-	-	+	-
24.	Epoxyisolinearol	-	-	-	+	-
	Beyerene Diterpene					
25.	Ent-7α,18-dihydroxybeyer-15-ene	+	-	+	-	-
	Pimarane Diterpene					
26.	2α-Hydroxy-8(14),15-pimaradiene	-	+	-	-	-
	Labdane Diterpene					
27.	Ent-6β,8α,dihydroxylabda-13(16),14-diene	-	-	-	-	+

TABLE 2. Antibacterial (MIC) Activity Test Results for Linearol (1), Foliol (2), Epicandicandiol (6), Siderol (10), and Ent-7α,18-dihydroxy-15β,16β-epoxykaurane (20)*,**

	1	**10**	**6**	**20**	**2**
B. subtilis ATCC 6633				> 625	> 625
S. aureus ATCC 6538			> 300		> 625
Ps. Aeruginosa ATCC 9027	> 625		> 300		
P. mirabilis ATCC 14153	> 625				> 625
E. coli ATCC	> 625		> 300		
K. pneumoniae ATCC 4352		> 600	> 300		
E. faecalis ATCC 29212	> 625		> 300		
C. albicans ATCC 10231					

*Minumum inhibition concentrations for compounds have been given as a mg/mL.

**it is performed by prof. Dr. C. B. Johansson (Marmara University, Department of Microbiology).

EXPERIMENTAL

Plant Material: *Sideritis athoa, Sideritis trojana, Sideritis dichotoma, Sideritis Spilyea,* and *Sideritis Argyrea* were collected from the Kazdagi region in June 1995. The plants were identified by Prof. Dr. K. H. C. Baser (Eskisehir); a voucher specimen was deposited in the Herbarium of the Faculty of the Pharmacy, Anadolu University.

General: The spectra were recorded with the following instruments: IR: Perkin–Elmer 980 in $CHCl_3$; NMR: Bruker AC-200 L, 200 MHz and 50.32 MHz for ^1H and ^{13}C-NMR, respectively, in $CDCl_3$; HRMS: VG ZabSPEC (maximum mass resolution 10.000). For isolation and purification of the compounds TLC: Kieselgel $60F_{254}$ (E.Merc) precoated plates, CC: Silicagel 60 and Sephadex LH-20 (Fluka) were used.

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