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ANTIMICROBIAL ACTIVITY OF *ARTEMISIA* SPECIES GROWING IN TURKEY

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SUMMARY

The antimicrobial activity of the plant extracts of Turkish *Artemisia* L. and of essential oils isolated from these species were investigated. *A. annua* L., *A. araratica* Krasch. extracts had effect on *Staphylococcus aureus, Mycobacterium smegmatis* and *Candida albicans; A. chamaemelifolia* Vill., *A. abrotanum* L. had effect on *M. smegmatis, C. albicans* whereas *A. scoparia* Waldst. et Kit. had effect only on *S. aureus* strain. Most of the essential oils had strong inhibitory effect on *C. albicans, M. smegmatis* and *S. aureus*. In constrast only *A. scoparia* Waldst. et Kit. essential oil showed inhibitory effect on *Pseudomonas aureginosa* strain.

Key Words: Turkish *Artemisia* species, extracts essential oils, antimicrobial activity.

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ÖZET

Türkiye'de yetişen *Artemisia* türlerinden elde edilen ekstrelerin ve uçucu yağların antimikrobiyal etkinliği incelenmiştir. *A. annua* L., *A. araratica* Krasch. ekstreleri *Staphylococcus aureus, Mycobacterium smegmatis* ve *Candida albicans*'a; *A. chamaemelifolia Vill. A. abrotanum* L. *Mycobacterium smegmatis, Candida albicans*'a etki yapmıştır. Uçucu yağların çoğu *Candida albicans, Mycobacterium smegmatis* ve *Staphylococcus aureus*'a güçlü inhibitör etkinlik göstermiştir. *Pseudomonas aeruginosa*'ya sadece *A. scoparia*'dan elde edilen uçucu yağ antimikrobiyal etki yapmıştır.

INTRODUCTION

Twentythree *Artemisia* species (Compositae) have been recorded in Flora of Turkey, which are distributed mainly in Eastern and Central Anatolia (1, 2).

Specimens belonging to 15 species were collected between 1985 and 1990 (Table 1), identified by Prof. Dr. N. Özhatay and voucher specimens are kept at the Herbarium of Faculty of Pharmacy, Istanbul University (ISTE).

Table 1: Procurement of Material

Artemisia species	ISTE Voucher	Locality	Distribution in Turkey (*)
1. *A. abrotanum* L.	55891	Ağrı 1650 m.	E.
2. *A. absinthium* L.	55849	Erzurum 1900 m.	
3. *A. annua* L.	56134	İstanbul s. l.	C., N. and S.
4. *A. araratica* Krasch.	57648	Malatya 1500 m.	C. and E.
5. *A. austriaca* Jacq.	a. 55856	Erzurum 1850	C. and E.
	b. 62525	Erzurum 1900 m.	
6. *A. caucasica* Willd.	58251	Çorum 900 m	C.
7. *A. chamaemellifolia* Vill.	58305	Kars 2050 m	E. and NE.
8. *A. incana* (L.) Druce	58293	Erzurum 1850 m.	E.
9. *A. marschalliana* Sprengel	62526	Erzurum 1900 m.	E. and NW.
10. *A. santonicum* L.	55992	Tekirdağ s. l.	C. and NW.
11. *A. scoparia* Waldst. et Kit.	a. 55289	Erzurum 1050 m.	C., E., S. and W.
	b. 59847	Malatya 950 m.	
12. *A. spicigera* C. Koch	55887	Ağrı 1700 m.	C. and E.
13. *A. splendens* Willd.	55906	Van 2700 m.	E.
14. *A. taurica* Willd.	55854	Erzurum 1850 m.	C. and E.
15. *A. vulgaris* L.	58294	Erzurum 1770 m.	E. and N.

(*) **C. Central; E. East; N. North; S. South; W. West (1-2).**

Among the *Artemisia* species: *A. absinthium* L., *A. abrotanum* L., *A. campestris* L., *A. santonicum* L. and *A. vulgaris* L. have been used in traditional medicine for their anthelmintic, diuretic, emmenagogue, febrifuge and tonic effects (3). *A. annua* L. has also been used in China as an antimalarial.

Today in Turkey, *A. absinthium* L. is being used for antidiabetic (4) and antimalarial treatment (5) in folk medicine.

This study is part of an ongoing of the bioactive compounds of Turkish *Artemisia* species (6, 7, 8, 5, 4, 9, 10, 11).

RESULTS AND DISCUSSION

Extracts of Turkish *Artemisia* species and their essential oils were examined. *A. annua*, *A. araratica* extracts had an inhibitory effect on *S. aureus*, *M. smegmatis* and *C. albicans*. *A. chamaemelifolia*, *A. abrotanum* extracts had an inhibitory effect on *M. smegmatis*. *C. albicans*, whereas *A. scoparia* had effect only on *s. aureus* strain. The other *Artemisia* species extracts were not inhibitiors of the microorganism (Table 2).

Table 2: Minimum inhibitory concentration (µg/ml) of the *Artemisia* extracts tested for antimicrobial activity.

Species used	Tested microorganism				
	E. coli	***P. aeruginosa***	***S. aureus***	***M. smegmatis***	***C. albicans***
Streptomycin	10	10	10	10	
A. abrotanum				1000	1000
A. absinthium					
A. annua			1000	1000	1000
A. araratica			1000	1000	1000
A. austriaca (a)					
A. austriaca (b)					
A. caucasica					
A. chamaemelifolia				1000	1000
A. incana					
A. marshelliana					
A. santonicum					
A. scoparia (a)			1000		
A. scoparia (b)					
A. spicigera					
A. splendens					
A. taurica					
A. vulgaris					

Most of the essential oils are active against *C. albicans, M. smegmatis* and *S. aureus*. In contrast less essential oil had an inhibitory effect on *E. coli*. Only one essential oil which was isolated from *A. scoparia* is active against *P. aeruginosa* strain (Table 3). It has been found out that the antimicrobial activity of the essential oil and extract of *A. scoparia*, which are obtained from two different regions, are different.

It is thought that the effect of the climate on the chemical composition causes difference.

Table 3: Minimum inhibitory concentration (µg/ml) of the *Artemisia* essential oils tested for antimicrobial activity.

Species used	Tested microorganism				
	E. coli	*P. aeruginosa*	*S. aureus*	*M. smegmatis*	*C. albicans*
Streptomycin	10	10	10	10	
A. abrotanum	1000			1000	1000
A. absinthium					100
A. annua			1000	100	100
A. araratica			100	1000	100
A. austriaca (a)			100	100	1000
A. austriaca (b)	1000		100	100	100
A. caucasica	1000		100	100	100
A. chamaemelifolia			100	100	100
A. incana			100	100	100
A. marshelliana				100	100
A. santonicum	100		100	100	100
A. scoparia (a)	1000	1000	100	100	100
A. scoparia (b)	1000		100	100	100
A. spicigera			1000	100	
A. splendens					100
A. taurica	100		100	100	100
A. vulgaris					1000

EXPERIMENTAL

Extraction and isolation. Dried and ground plant specimens (Table 1) was extracted by maceration with 95% EtOH. The solvent was removed in vacum below 40°C Essential oil was isolated from dried plant with steam distilation.

Test material. *Artemisia* extracts and of their essential oils, subjected to antimicrobial screening in 100 µg/ml, 1000 µg/ml (w/v) dilutions.

Used microorganism. Four bacteria were obtained from the American Type Culture Collection (ATCC), and one fungi from Pasteur Institute (IR). They are listed in Table 4.

Table 4: Microorganism used in screening *Artemisia* sp. for antimicrobial activity.

Number	Microorganism	No	Classification
1.	*Escherichia coli*	ATCC 25922	Gram negative
2.	*Pseudomonas aeruginosa*	ATCC 27853	Gram negative
3.	*Staphylococcus aureus*	ATCC 25923	Gram positive
4.	*Mycobacterium smegmatis*	ATCC 607	Acid fast
5.	*Candida albicans*	IP 628	Yeast

Antimicrobial activity. A loopful from the suspension of each microorganism (1/100 dilution of 24. hour broth culture) was streaked on double plates of DST agar (Digco) containing 100 µg/ml and 1000 µg/ml *Artemisia* extract or essential oil. The inoculated plates were incubated at 37°C for 24-48 hours. Plates containing 10 µg/ml streptomycin or no activ substance were inoculated for the control test. No growth of microorganism at the end of the incubation period was considered as inhibitory activity of the *Artemisia* extract and essential oil. Streptomycin inhibits all the test microorganism except for *C. albicans* (12).

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