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An Investigation on Antimicrobial and Antioxidant Activity of the Essential Oil of Some Traditional Medicinal Plants in Turkey

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Abstract: *The object of this study is to analyzein antimicrobial activities and radical scavenging of essential oilsof Artemisia absinthium L, Artemisia austriacajaq, Tanacetumdensum (lab). Schultz Bip.subsp, Sivasicum Hub-Mor @GriersonTanacetumvulgare (Asteraceae)obtained from 4 plant species member ofastreceaewhich were selected in use of Turkish medicine.Searching for possible antioxidant activity of samples was evaluatedby β-carotene-linoleic acid and 2, 2-diphenyl-1- picrylhydrazyl (DPPH) assays.Antimicrobial, antifungal activities and minimalinhibitory concentration (MIC) valueswere investigated for essential oils of plantsvia disc diffusion method.AA have a strong activity as an antioxidant although the all of essential oilshave been showedweak activities of antimicrobial, antioxidant as studied in laboratory settings. This research is first study that invitro antioxidant and antibacterial activity of volatile oil of Artemisia and tanacetum species belonging to Asteraceae class.*

Keywords*: Asteraceae, Antimicrobial activity, Antioxidant activity, Sivasicum Hub-Mor @Grierson*,Artemisia absinthium L, Artemisia austriacajaq, Tanacetumdensum(lab). Schultz Bip.subsp, Tanacetumvulgare*

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I. Introduction

Artemisia has 23 species in the Turkish flora in which 6 of them are naturally grown in southwestern and western Anatolia (Baytop 1984; Chiasson et al., 2001; Davis 1982; Davis 1988; Demirci 2012; Hammer 1999; Sezik et al., 2001). Endemic species ***Artemisia austriaca*jaq (A.Aus)** is annual or perennial herb. They may exhibit antifungal, antiviral, antitumor, antipyretic, antioxidant, antihemorrhagic,anticoagulant and antihepatic activity (Dülger et al., 1999;Tariq et al., 2009). ***Artemisia absinthium*** L (**A.A**) is also known locally as 'pelin'. It is used as a medicinal cure through worldwide, such as antimalarial, antiprotozoal, cytotoxic, antioxidant,antipyretic, antimicrobial, antiradical, anthelmintic, neurotropic, andantidepressant etc. (Altunkaya et al., 2014; Canadanovic et al., 2005; Dülger et al., 1999; Erel et al., 2012; Juteu et al., 2003; Judzentiene et al., 2012; Kordalı et al., 2005 (a,b); Mahmoudi et al., 2009; Rezaeinodehl and Khangholi 2008; Tariq et al., 2009; Yiğit et al., 2009). The essential oil is today considered toxic and potentially fatal; it contains thujone, a convulsant and narcotic (Judzentiene et al., 2012).

Tanacetumtaxa are known in Turkey as "pireotu" and their essential oils are used in as insectrepellent. The genus **Tanacetum**has over 200 species and grown in West Asia and Europe. Tanacetum haveperennial taxa. There are 45 speciesin Turkey which 18 of them are endemic with four subtypes as a ratio 40% (Baytop 1984; Chiasson et al., 2001; Davis 1988; Davis 1982; Demirci 2012; Hammer 1999; Kumar and Tyagi 2013; Sezik et al., 2001) ***Tanacetumdensum*** **(lab). *Schultz*Bip.*subsp*, Sivasicum *Hub*-Mor @Grierson (T.D)**. The species of genus Tanacetum have been used in medicine as spasmolytics,expectorants and antiseptic vermifuges(Gören et al., 1992; Kumar and Tyagi 2013; Tepe and Sökmen 2007).***Tanacetumvulgare*,(TV)**has been used as a medicinal herb and as an anthelminticdespite of its toxicityfor many years(Chiasson et al., 2001; Collin et al., 1993; Mikulasova and Vaverkova 2009; Muresan 2015; Polatoğlu et al., 2015; Raal et al., 2014; Schinella et al., 1998).

Theessential oils of the plants are used as amedicinevia externally, orally or inhalation. Thus, the metabolism and elimination andtoxic effects of these oils need to be well known. Researchers have been reported to the biological activity of extracts and essential oils of Artemisia and Tanacetum species. However, it hasn't been found in several reports regarding TD and A.Aus activities which are endemic species. This research is the first study that invitro antioxidant and antibacterial activity of volatile oil of Artemisia and Tanacetum species belonging to Asteraceae class.

II. Materials And Methods

Taxonomic identification and plant collection was madein the course of flowering inDivriği (1200 m), Sivas-Turkey. The specimen was identified by Dr. ErolDonmez and stored at the herbarium of the department of biology, Cumhuriyet University, Sivas-Turkey. *Artemisia absenthıum L* (CUFH-Voucher No: ED 11018), *Artemisia austriaca*jacq (CUFH-Voucher No: ED 11017) *(astreceae),* Tanacetumdensu (lab). *Schultz* Bip .*subsp*, Sivasicum *Hub*-Mor @Grierson (CUFH-Voucher No: ED 11016),*Tanacetumvulgare*(CUFH-Voucher No: ED11015). Clevenger-type apparatus were used toisolate of the essential oil about 3 h. The essential oil were filtered in anhydrous sodium sulphate and kept at +4°C.

Antibacterial assay:

Activities of antimicrobial and antifungal for essential oil were differenced against for *Candida albicans*ATCC-10231, *Pseudomonas aeruginosa* ATCC-27853, *Bacillus subtilis* ATCC-6633, *Klebsiellapneunomoniae*NCTC-5046, *Salmonella thyphi* NCTC-9394, *Staphylococcus aureus* ATCC-25923,*Escherichia coli* ATCC- 35218,*Proteus vulgaris* RSHM-96022and *Corynebacteriumdiphteriae*RSHM-633which were obtained from the Departmentof Health of RefikSaydam Hygiene Center Contagious Diseases Research Department (Ankara, Turkey)via disc diffusion method. Mueller Hinton agar (MHA-Oxoid-CM 337) and Sabouradud dextrose agar (Oxoid-CM41) were used in culturing. The experiments were been studied in three times. Average and standard deviation (SD) were figure out for inhibition zone diameters.

The determination on antimicrobial activities of the essential oil in question was employed by Disc diffusion method Agar (Blois 1958; Bruits and Bucar, 1958). The inhibition zones were calculatedasmillimeters. Abroth microdilution sensitivity assay was usedfor identifying of minimum inhibitory concentration by NCCLS (NCCLS 1999; NCCLS 1997). Except the yeasts (sabouraud dextrose broth-SDB; DIFCO), all tests were studied in Mueller Hinton Broth (MHB; OXOID-CM405). The MIC of clindamycin,amikacin and ciprofloxacin were determined the sensitivity of organisms. Antioxidant activity has been studied withdiphenylpicrylhydrazyl (DPPH) assay (Blois 1958; Bruits and Bucar 2000). All tests were studiedthree times.

III. Results And Discussion

β-carotene-linoleic acid inhibition systems showed weak antioxidant activity in essential oil of all the plants except AA. Despite AA volatile oil showed strong activation in β-carotene-in linoleic acid and DPPH system(Table1). In the antibacterial and antifungal activity examination, all plant essential oils were more effective in Gram (+) bacteria. AA, A.Aus and TVwereinhibitedfor in*S. aureus*, TD *C. diphtheriae, C. albicans* and TVwereinhibitedforC.*diphteri*, *B.subtillis*while AA was activefor*K. Pneumoniae*. While the most potent antioxidant activity was found in AA, the most potent antibacterial activity was found as TV which makes inhibition 3 times stronger compared to gentamicin.The results are shown in Table 2.

Studies belong to the biological activity of essential oils and extracts of Artemisia and Tanacetum species are found in literature researches which are made (Altunkaya et al., 2014; Canadanovic et al., 2005; Chiasson et al., 2001; Collin et al., 1993; Dülger et al., 1999; Erel et al., 2012; Gören et al., 1992; Juteu et al., 2003; Judzentiene et al., 2012; Kordalı et al., 2005 (a,b); Kumar and Tyagi 2013; Mahmoudi et al., 2009; Mikulasova and Vaverkova 2009; Polatoğlu et al., 2009; Polatoğlu et al., 2015; Raal et al., 2014; Rezaeinodehl and Khangholi 2008; Schinella et al., 1998; Tariq et al., 2009; Tepe and Sökmen 2007; Yiğit et al 2009). However, it has been found in several reports regarding TD and A.Aus activities which are endemic species (Altunkaya et al., 2014; Gören et al., 1992; Polatoğlu et al., 2009; Polatoğlu et al., 2015;Tepe and Sökmen 2007).

AA review of the composition of essential oils, B-myrcene camphor and thujene was reported as partner dominant material (Altunkaya et al., 2014; Juteu et al 2003; Judzentiene et al 2012; Kordalı et al., 2005 (a,b); Rezaeinodehl andKhangholi 2008).

In antibacterial, antifungal, (Altunkaya et al., 2014; Dülger et al., 1999; Erel et al., 2012; Juteu et al., 2003; Judzentiene et al., 2012; Kordalı et al., 2005a; Rezaeinodehl and Khangholi 2008; Yiğit et al., 2009),antioxidant (Altunkaya et al., 2014; Erel et al., 2012; Kordalı et al., 2005 (a,b); Mahmoudi et al., 2009) and toxic activity studies (Judzentiene et al., 2012), it has been reported that showed moderately strong activity and *S.aereus* and *K. pneumonia* has also been reported to be effective.

Altunkaya et al., (2014) reported thatA.Aus. as an endemic species. Major component of oil has identified as camphor and it reported in weak antioxidant activity weak antibacterial activity (*S. aureus* effective) and the antioxidant activity studies which is made by ABTS method(Altunkaya et al., 2011).In this study the most potent antioxidant activity was found in AAin essential oil of among the plantsvia β-carotene-linoleic acid inhibition systems.

A few study have been reported as the dominant component the essential oil which is an endemic species including 1.8 cineol and camphor (Gören et al., 1992; Kumar and Tyagi 2013; Polatoğlu et al., 2009; Polatoğlu et al., 2015). Gören et al., 1992 has reported that antibacterial activity of essential oils while another

study has identified weak antioxidant activity(Tepeand Sökmen, 2007)in which are made with TD extract, *B. subtilis* and *K. pneumonia*. Polatoğlu et al., (2015) reported that show strong insecticidal effects and low toxicity of essential oil.In this study antibacterial and antifungal activity examination, all plant essential oils were more effective in Gram (+) bacteria. AA, A.Aus and TVwereinhibitedfor in*S. aureus*, TD *C. diphtheriae, C. albicans* and TVwereinhibitedforC.*diphteri*, *B.subtilis*while AA was activefor*K. Pneumoniae*..The most potent antibacterial activity was found as TV which makes inhibition 3 times stronger compared to gentamicin.
T.V β-thujone, trans-thujone, camphor has an active ingredient (Collin et al., 1993;Mikulasova and Vaverkova 2009; Raal et al., 2014; Schinella et al., 1998). It has been reported that potent acarcical activity (Chiasson et al., 2001) and been effective anti-inflammatory (Raal et al., 2014). This research is first study that invitro antioxidant and antibacterial activity of volatile oil of Artemisia and tanacetum species belonging to Asteraceae class. This study will be the beginning for further studies.

Table1. *Artemisia absinthium* L.,*Artemisia austriaca*jaq, *Tanacetumdensum* (lab). *Schultz* Bip.*subsp*, Sivasicum *Hub*-Mor @Grierson*, *Tanacetum*vul*gare*(Asteraceae) essential oil and on the in vitro free radical DPPH and β-carotene-linoleic acid system

SAMPLES	Inhibition IC_{50} (mg/ml) (DPPH)	Inhibition % (β-carotene- Linoleic acid)
Artemisia absinthium L.	0.210	43
*Artemisia austriaca*jaq.	-	16
Tanacetumdensum	-	18
Tanacetumvulgare	-	15
BHT	0.0105	100

Table 2. Activity of antimicrobial, antifungalandminimalinhibitionconsentration (MIC) valuesof the essential oils.

	P. aeruginosa		*E. coli*		*S. thyphi*		*K.pneumoni*		*P.vulgaris*		*S. aureus*		*B. subtilis*		*C. diphteriae*		*C. albicans*	
	a*	b*	a*	b*	a*	b*	a*	b*	a*	b*	a*	b*	a*	b*	a*	b*	a*	b*
A.A	11±3	28.3	13±3	22.5	6±2	26.4	29*±4	17.2	15±3	23.4	26±9	11.8	25±5	14.7	17±1	24.5	12±7	18.6
A.Aus	7 ±7	15.4	10±5	19.5	9±8	11.6	20±6	14.3	11±1	11.8	46±7	16.5	20±7	16.5	15±4	20.4	22±7	16.3
T.D	8 ±1	9.7	12±2	16.2	14±6	16.9	20±2	13.4	10±3	19.7	14±3	4.4	14±3	6.5	30±5	11.3	32±3	10.3
T.V	6 ±3	12.4	6±4	16.3	8±3	20.3	11±9	21.4	6±7	19.6	90±5	8.3	90±4	10.2	48±4	21.4	6±5	20.8
Gentam	20 ±1.06		16±1.06		10± 0,45		20± 0.70		22± 1.40		23±0.76		29± 1.15		23± 1.10		-	
Nyst	-		-		-		-		-		-		-		-		25±0.90	

a*:AgarDiscDiffusionMethod, b*:Minimal InhibitionConsentration (MIC)

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