EurAsian Journal of BioSciences
EurAsia J BioSci 4, 28-37 (2007)

Antimicrobial activities and usage in folkloric medicine of some Lamiaceae species growing in Mugla, Turkey

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Abstract

In this study; 23 selected plant species belonging to the Lamiaceae family, used in traditional treatments, were collected from different localities of Mugla, dried and extracted with ethanol using the soxhlet extraction apparatus. The antimicrobial activities of the plant extracts on the various test microorganisms, including multiple antibiotic resistant bacteria, were investigated. Antimicrobial activities of the extracts were determined by the disc diffusion method. Test microorganisms were; 7 Gram positive, 7 Gram negative bacteria and *Candida albicans*. Also different standart antibiotic discs were used for comparison for the inhibition zones. The antimicrobial activities of the ethanolic extracts of *Salvia verbenaca*, *Teucrium chamaedrys* ssp. *lydium*, *Teucrium divaricatum* ssp. *villosum*, *Teucrium polium*, *Stachys annua* ssp. *annua* var. *annua*, *Sideritis albiflora*, *Sideritis leptoclada* and *Prunella vulgaris* demonstrated the inhibition effects against Gram positive bacteria including multiple antibiotic resistant *Staphylococcus* strains. The ethanolic extract of *S. leptoclada* was the most effective extract. On the contrary, all of the ethanolic extracts were not effective on Gram negative bacteria and *C. albicans*. The ethanolic extracts of the plants, which inhibited the bacteria, mostly inhibited the growth of *Staphylococcus aureus* ATCC 25923, MU 38, MU 44 and *Staphylococcus epidermidis*. Even the inhibition zone of *S. leptoclada* on *S. aureus* ATCC 25923 was greater than the inhibition zone of oxacillin on the same bacteria.

Keywords: Antibiotic resistant bacteria, antimicrobial activity, folkloric medicine, Lamiaceae.

Sarac N, Ugur A (2007) Antimicrobial activities and usage in folkloric medicine of some Lamiaceae species growing in Mugla, Turkey. EurAsia J BioSci 1, 4, 28-34.
www.ejobios.com/content/1/4/28-34

INTRODUCTION

In recent years, drug resistance to human pathogenic bacteria has been commonly and widely reported in literature (Mulligen et al. 1993, Davis 1994, Robin et al. 1998). Because of the side effects and the resistance that pathogenic microorganisms build against antibiotics, many scientists have recently paid attention to extracts and biologically active compounds isolated from plant species used in herbal medicines (Essawi and Srour 2000). Antimicrobial properties of medicinal plants are being increasingly reported from different parts of the world (Saxena 1997, Nimri et al. 1999, Saxena and Sharma 1999).

It has been reported that the higher plants have shown to be a potential source for the new antimicrobial agents (Mitscher et al. 1987). The antimicrobial compounds from plants may inhibit bacterial growth by different mechanisms than those presently used. Antimicrobials therefore, may have a significant clinical value in treatment of resistant microbial strains (Eloff 1988). In particular, the antimicrobial activity of plant oils and extracts have formed the basis of many applications including raw and processed food preservation, pharmaceuti-

Received: June 2007
Accepted: August 2007
Printed: November 2007

cals, alternative medicine, and natural therapies (Hammer et al. 1999).

Lamiaceae species are important for the antimicrobial activities among plants, which are used in research of antimicrobial activity. Turkey is regarded as an important gene-center for the family Lamiaceae (Labiatae)(Baser 1993). The family is represented by 45 genera and 574 species. The family has 256 endemic species, which are endemic to Turkey, and the rate of endemism in the family is %44 (Erik and Tarikahya 2004).

Since it is located at the intersection of three large phyto-geographic regions, Turkey is very reach in flora. The main part of Turkey, Anatolia, which has the appropriate climate, topography and soil characteristics, is the origin of many medicinal plants. Mugla province and the surrounding areas located between the Mediterranean and Aegean Regions of Anatolia has especially reach flora. Besides, ecological characteristics, the variable topography of Mugla province increases this diversity even further. Including the Lamiaceae species, Mugla province has a large medicinal and aromatic flora, most of which are endemic to the area. Naturally growing many Lamiaceae members have been used as a tea, a spice or for medicinal purposes by the public for centuries.

Natural products can be selected for biological screening based on ethnomedical use of plants, because many infectious diseases are known to have been treated with herbal remedies throughout the history of mankind. Even today, plant materials continue to play a major role in primary health care as therapeutic remedies in many developing countries (Zakaria 1991, Sokmen et al. 1999).

In this study, some species of Lamiaceae, having traditional claims for several diseases (Table 1) were investigated for the antimicrobial activities on bacterial strains, which were antibiotic resistant bacteria. The ethnobotanical data on the traditional uses of these plant species and selection of the plant parts to be tested was complemented with a literature review and information gathered from traditional healers.

MATERIAL AND METHODS

Plant materials

The following plant materials *Ballota acetabulosa* (L.) Bentham, *Ballota nigra* L. ssp. *foetida* Hayek, *Phlomis lycia* D. Don, *Phlomis fruticosa* L., *S. verbenaca*, *Salvia argentea* L., *Salvia candidissima* Vahl ssp. *occidentalis* Hedge, *T. chamaedrys* ssp. *lydium*, *T. divaricatum* ssp. *villosum*, *T. polium*, *Marrubium vulgare* L., *Marrubium globosum* Montbret & Aucher ssp. *globosum*, *Stachys annua* (L.) L. ssp. *annua* var. *lycaonica* Bhattacharjee, *Stachys cretica* L. ssp. *smyrnaea* (Boiss.) Rech., *S. annua* ssp. *annua* var. *annua*, *S. albiflora*, *S. leptoclada*, *Lamium moschatum* Miller var. *moschatum*, *Melissa officinalis* L. ssp. *officinalis*, *Micromeria juliana* (L.) Bentham, *P. vulgaris*, *Ajuga chamaepitys* (L.) Schreber ssp. *chia* (Schreber) Arcangeli var. *chia* and *Clinopodium vulgare* L. ssp. *vulgare* were collected at the flowering stage in May-September, 2003 from the Mugla region of Turkey. Voucher specimens of the plants were collected, taxonomically identified, and deposited at the Herbarium of the Department of Biology at Mugla University.

Preparation of the ethanolic extracts

The air dried and powdered aerial parts of the plant samples were extracted with ethanol (Merck) using the Soxhlet apparatus. The extract was evaporated and then extracted in 1/1 bidistillation water/ethanol, and then kept in small sterile opac bottles under refrigerated conditions until used.

Microorganisms and condition for cultivation

In this study; *Bacillus subtilis* ATCC 6633, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, *S. aureus* ATCC 25923, *C. albicans* ATCC 10239, *Streptococcus mutans* CNCTC 8/77, *Micrococcus luteus* NRRL B- 4375 were used. And also *Pseudomonas fluorescens* MU 87, *Pseudomonas stutzeri* MU 70, *Stenotrophomonas maltophilia* MU 64, *S. maltophilia* MU 99, *Chryseomonas luteola* MU 65, *S. aureus* MU 38, *S. aureus* MU 44 and *S. epidermidis* MU 30, which are multiple

Table 1. Traditional name, used parts and traditional usages of the plants belonging to the Lamiaceae.

Botanical name	Traditional name	Used parts	Traditional usage
A. chamaepitys	Yercami, bodurot, yer servisi, yer cami, aci yavsan, kurtluca, mayasil otu, kisamahmut otu	Aerial parts	Diuretic, dysmenorrhea, insect and snake bite poison exposure, stimulant, to improve wound, sweat, hemorroid
A. chamaepitys ssp. *chia* var. *chia*	Basurotu	Aerial parts	Hemorroid
B. nigra	Yalanci isirgan, boz otu, leylim otu, kopek otu, kara yer pirasasi, kurt dusurucu	Flowered aerial parts	Sedative, diuretic, digestive, antiparasitic, dysmenorrhea, hemorroid, wound therapy, antiseptic, antiinflammatory
B. acetabulosa	-	Aerial parts	Hemorroid
C. vulgare	-	-	-
Lamium sp.	-	-	Constipation, stimulant
M. vulgare	Bozotu, it sinegi, yalanci isirgan, kara derme, kopek otu, mayasil otu, kukas otu	Flowered aerial parts	Diuretic, carminative, expectorant, mucolytic, cough, sore throat, diseases of respiratory system, cicatrizing, stimulant, febrifuge
M. globosum	-	-	-
M. officinalis ssp. *officinalis*	Ogul otu, melisa, adi ogul otu, kovan otu, limon nanesi, limon otu, terme otu, tatramba	Fresh and dried leafs	Sedative, carminative, against sweat, antiseptic, antispasmodic, common cold, diarrhea, dyspeptic complaint
Micromeria sp.	-	Dried leafs	Appetizing, carminative, heart diseases, headaches, wound healing and dermal infections, common cold
Phlomis sp.	-	Inflorescence, leafs	Appetizing, stimulant, carminative, stomach pain, tonic, dyspeptic complaint
P. fruticosa	-	Inflorescence, leafs	Similar to the *Phlomis* using
P. lycia	Deli salba	Inflorescence, leafs	Similar to the *Phlomis* using
P. vulgaris	-	Flowered parts	Expectorant
S. argentea	-	-	-
S. candidissima ssp. *occidentalis*	-	-	-
S. verbenaca	Yabani adacayi	Leafs, seeds	Constipation, against sweat, sedative, eye diseases, dyspeptic complaint
Sideritis	Adacayi, dag cayi	Inflorescence, leafs	Antiinflammatory, analgesic, nervous stimulation, sedative, antitussive, anticonvulsant, antispasmodic, carminative, common cold, antitussive, digestive system diseases, stimulant, appetizing, stomach pain relief, dyspeptic complaint
S. albiflora	Yayla cayi	Inflorescence, leafs	Similar to the *Sideritis* using
S. leptoclada	Kizlan cayi	Inflorescence, leafs	Similar to the *Sideritis* using
Stachys	Dag cayi	Inflorescence, leafs	Appetizing, stimulant, carminative, relief of gastric pain, dyspeptic complaint
S. cretica	Salba cayi	Inflorescence, leafs	Dyspeptic complaint
T. chamaedrys	Kisamahmut otu, yer mesesi, dalak otu, mayasil otu, kisacik, mahmut, bodur mahmut, sitma otu, sicak otu, basur otu, kizil, ana baba kokusu	Dried aerial parts with flower	Appetizing, relief of gastric pain, stimulant, antipyretic, tonic, stomach diseases, diabetes, hemorroid, peripheric edema, pneumonia, abdominal pain, malaria
T. divaricatum	Kirmizi cicekli kisamahmut	Flowered parts	Appetizing, relief of gastric pain, stimulant, antipyretic, tonic, stomach diseases, diabetes, hemorroid, peripheric edema, pneumonia, abdominal pain, malaria
T. polium	Aci ot, ak sedef otu, ana baba kekigi, basur otu, beyazot, cadi, kepir yavsani, meryem otu, oglan otu, peryavsan, sanci otu, siraca otu, yavsan otu, kisamahmut otu, yer cami, tuylu kısamahmut, mayasil otu, yag kekigi, koyun otu, merven, kirkekigi, mahmut otu, yer mesesi, aci yavşan paryavsan, boz bagir otu	Aerial parts	Appetizing, relief of gastric pain, ulcer, common cold, bronchitis, hemorroid, abdominal pain, vomiting, pneumonia, diarrhea, internal diseases, vasoconstrictive, eczema, tootache, rheumatism, fever

(-): No obtained records

antibiotic resistant bacteria, were used in this study.

S. aureus, *S. epidermidis*, *E. coli*, *M. luteus*, *B. subtilis* were cultured in Nutrient Broth (NB) (Difco) at 37 ± 0.1°C; *S. mutans* were cultured in Brain Heart Infusion Broth (BHIB) (Difco) at 37 ± 0.1°C; *P. aeruginosa*, *P. fluorescens*, *P. stutzeri*, *S. maltophilia*, *C. luteola* were cultured in Nutrient Broth (NB) (Difco) at 30 ± 0.1°C and *C. albicans* was cultured in Sabouraund Dextrose Broth (SDB) (Difco) at 30 ± 0.1°C.

Antimicrobial assays

The antimicrobial activities of the ethanolic extracts of plants were analysed by the disk diffusion method (Collins et al. 1995, Murray et al. 1995).

The inoculum size of each group of bacteria and yeast were prepared by using a no. 0.5 McFarland tube to give a concentration of $1x10^8$ bacteria and $1x10^6$ yeast per milliliter. Mueller Hinton Agar (MHA) (Difco), Brain Heart Infusion Agar (BHIA) (Difco) and Sabouraund Dextrose Agar (SDA) (Difco) sterilized in a flask and cooled to 45-50°C was distributed to sterilized petri dishes with a diameter of 9 cm (15 mL) after

inoculating cultures (0.5 mL) of bacteria and yeast and distributing medium in petri dishes homogeneously. The plates were held for 15-20 minutes at room temperature. Each essential oil (20 µL) was applied under suction to the sterile 6 mm discs (Schleicher& Schuell). Discs injected with the ethanolic extracts were placed on the solid agar medium by pressing slightly. Plates inoculated with *C. albicans* were incubated at 30ºC for 48 h, with *S. aureus*, *S. epidermidis*, *S. mutans*, *E. coli*, *M. luteus*, *B. subtilis* at 37ºC for 24 h and with *P. aeruginosa*, *P. fluorescens*, *P. stutzeri*, *S. maltophilia*, *C. luteola* at 30ºC for 24 h. At the end of the incubation periods, the diameters of the inhibition zones formed on the MHA, BHIA and SDA were evaluated in millimetres. Discs of Penicillin (10 U), Ampicillin (10 mcg), Amoxicillin + Clavulanic Acid (20 mcg/10 mcg), Imipenem (10 mcg), Cefaperazon (75 mcg), Methicillin (5 mcg), Oxacillin (1 mcg), Gentamicin (10 mcg), Nystatine (30 mcg) were used as positive controls. Studies were performed in triplicate, and the developing inhibition zones were compared with those of the reference discs.

RESULTS

The antimicrobial activities of the ethanolic extracts of *B. acetabulosa*, *B. nigra* ssp. *foetida*, *P. lycia*, *P. fruticosa*, *S. verbenaca*, *S. argentea*, *S. candidissima* ssp. *occidentalis*, *T. chamaedrys* ssp. *lydium*, *T. divaricatum* ssp. *villosum*, *T. polium*, *M. vulgare*, *M. globosum* ssp. *globosum*, *S. annua* ssp. *annua* var. *lycaonica*, *S. cretica* ssp. *smyrnaea*, *S. annua* ssp. *annua* var. *annua*, *S. albiflora*, *S. leptoclada*, *L. moschatum* var. *moschatum*, *M. officinalis* ssp. *officinalis*, *M. juliana*, *P. vulgaris*, *A. chamaepitys* ssp. *chia* var. *chia* and *C. vulgare* ssp. vulgare were determined in this study. All of the plants, studied, had no effect on the Gram negative bacteria and *C. albicans* (Data not shown).

The inhibition zone diameter of the ethanolic extracts to the Gram positive test bacteria shown in Table 2. The inhibition zone diameter of the reference antibiotics to the Gram positive test bacteria are shown in Table 3. The ethanolic extracts of this plants inhibited the growth of Gram positive bacteria and the inhibition zones ranged between 7-18 mm. The antibacterial activities were wide variations according to the species, subspecies or variety.

For example, *P. lycia* had no antibacterial

Table 2. Antibacterial activities of the investigated plants ethanolic extracts.

Plants	Gram positive test bacteria						
	B. subtilis ATCC 6633	*M. luteus* NRRL B- 4375	*S. mutans* CNCTC 8/77	*S. aureus* ATCC 25923	*S. aureus* MU 38	*S. aureus* MU 44	*S. epidermidis* MU 30
A. chamaepitys ssp. *chia* var. *chia*	-	-	-	-	-	-	-
B. acetabulosa	-	-	-	-	-	-	-
B. nigra ssp. *foetida*	-	-	-	-	-	-	-
C. vulgare	-	-	-	-	-	-	-
L. moschatum var. *moschatum*	-	-	-	-	-	-	-
M. globosum ssp. *globosum*	-	-	-	-	-	-	-
M. vulgare	-	-	-	-	-	-	-
M. officinalis ssp. *officinalis*	-	-	-	8	-	-	10
M. juliana	-	-	-	-	-	-	12
P. lycia	-	-	-	-	-	-	-
P. fruticosa	-	-	-	-	-	-	11
P. vulgaris	11	-	-	11	10	10	15
S. verbenaca	9	-	-	11	9	10	9
S. argentea	-	-	-	8	-	-	7
S. candidissima ssp. *occidentalis*	-	-	-	-	-	-	-
S. albiflora	8	-	-	8	9	9	13
S. leptoclada	9	9	-	13	12	11	18
S. annua ssp. *annua* var. *annua*	-	-	-	8	8	8	9
S. annua ssp. *annua* var. *lycaonica*	-	-	-	-	-	-	-
S. cretica ssp. *smyrnaea*	-	-	-	10	-	-	13
T. chamaedrys ssp. *lydium*	-	-	-	8	-	9	14
T. divaricatum ssp. *villosum*	10	-	-	10	9	8	14
T. polium	-	-	-	9	8	8	11

(-): No zone
ATCC: American Type Culture Collection, CNCTC: Czechoslovak Collection of Type Cultures, NRRL: Northern Regional Research Laboratory, MU: Mugla University Culture Collection

Table 3. Inhibition zone diameter of the reference antibiotics to the Gram positive test bacteria.

Gram positive test bacteria	Reference Antibiotics						
	P	AM	AMC	IPM	CFP	ME	OX
	Inhibition Zone Diameter (mm)						
B. subtilis ATCC 6633	11	-	23	48	19	NT	NT
M. luteus NRRL B-4375	32	29	32	36	26	NT	NT
S. mutans CNCTC 8/77	15	12	20	20	14	NT	NT
S. aureus ATCC 25923	21	17	20	NT	NT	15	12

P: Penicillin (10 U), AM: Ampicillin (10 mcg), AMC: Amoxicillin + Clavulanic Acid (20 mcg/10mcg), IPM: Imipenem (10 mcg), CFP: Cefaperazon (75 mcg), ME: Methicillin (5 mcg), OX: Oxacillin (1 mcg), (-): No zone, NT: Not tested

activity on the bacteria but *P. fruticosa* had antibacterial activity on *S. epidermidis*. Similarly, *S. candidissima* ssp. *occidentalis* did not have any effect of growth on the bacteria, but *S. verbenaca* showed antibacterial activity on *B. subtilis* and all of the Staphylococci, including multiple antibiotic resistant bacteria (*S. aureus* MU 38, *S. aureus* MU 44 and *S. epidermidis* MU 30). *S. argentea*, the another species of the same genus, had antibacterial activity only on *S. aureus* ATCC 25923 and *S. epidermidis* MU 30.

Species and subspecies of *Teucrium*, were used in this study and in general, showed antibacterial activities on Staphylococci. All of the *Teucrium* species, that was used, had maximum antibacterial activity on *S. epidermidis* MU 30, while the ethanolic extract of *S. annua* ssp. *annua* var. *lycaonica* had no antibacterial activity, the ethanolic extract of *S. annua* ssp. *annua* var. *annua*, a different variety of the same subspecies, had antibacterial activities on the Staphylococci. The ethanolic extract of *S. cretica* ssp. *smyrnaea* showed antibacterial activities on *S. aureus* ATCC 25923 and *S. epidermidis* MU 30. The ethanolic extracts of *S. leptoclada* and *S. albiflora* had antibacterial activities on *S. aureus* MU 38, *S. aureus* MU 44 and *S. epidermidis* MU 30, which were multiple antibiotic resistant bacteria. The maximum antibacterial activities of *S. albiflora* and *S. leptoclada* were on *S. epidermidis* MU 30. The ethanolic extract of *S. leptoclada* showed more antibacterial activity than the *S. albiflora* extract.

The antibacterial activity of the ethanolic extract of *M. juliana* was only on *S. epidermidis* MU 30. The ethanolic extract of *P. vulgaris* showed antibacterial activities on Gram positive bacteria, except *M. luteus* and *S. mutans*. The antibacterial activities of its extract were determined on *S. aureus* MU 38, *S. aureus* MU 44 and S. epidermidis MU 30.

S. verbenaca, *T. chamaedrys* ssp. *lydium*, *T. divaricatum* ssp. *villosum*, *T. polium*, *S. annua* ssp. *annua* var. *annua*, *S. albiflora*, *S. leptoclada* and *P. vulgaris* were effective species, but *S. leptoclada* was the most effective species used in this study.

The antibacterial activities of the ethanolic extracts of *B. acetabulosa*, *B. nigra* ssp. *foetida*, *P. lycia*, *S. candidissima* ssp. *occidentalis*, *M. vulgare*, *M. globosum* ssp. *globosum*, *S. annua* ssp. *annua* var. *lycaonica*, *L. moschatum* var. *moschatum*, *A. chamaepitys* ssp. *chia* var. *chia* and *C. vulgare* ssp. *vulgare* were not observed.

DISCUSSION

B. acetabulosa, *B. nigra* ssp. *foetida*, *P. lycia*, *P. fruticosa*, *S. verbenaca*, *S. argentea*, *S. candidissima* ssp. *occidentalis*, *T. chamaedrys* ssp. *lydium*, *T. divaricatum* ssp. *villosum*, *T. polium*, *M. vulgare*, M. *globosum* ssp. *globosum*, S. *annua* ssp. *annua* var. *lycaonica*, *S. cretica* ssp. *smyrnaea*, *S. annua* ssp. *annua* var. *annua*, *S. albiflora*, *S. leptoclada*, *L. moschatum* var. *moschatum*, *M. officinalis* ssp. *officinalis*, *M. juliana*, *P. vulgaris*, *A. chamaepitys* ssp. *chia* var. *chia* and *C. vulgare* ssp. *vulgare* were selected based on their relevant ethnomedical use. Antimicrobial activities of all of them were evaluated. Ethanolic extracts of *P. fruticosa*, *S. verbenaca*, *S. argentea*, *T. chamaedrys* ssp. *lydium*, *T. divaricatum* ssp. *villosum*, *T. polium*, *S. cretica* ssp. *smyrnaea*, *S. annua* ssp. *annua* var. *annua*, *S. albiflora*, *S. leptoclada*, *M. officinalis* ssp. *officinalis*, *M. juliana* and *P. vulgaris* had antibacterial activities against several pathogenic bacteria. In general, the ethanolic extracts of these plants have had antibacterial activities on Gram positive bacteria, especially Staphylococci.

Staphylococci are among the most commonly encountered pathogens in clinical

practice. *S. aureus* is a major cause of nosocomial infections, food poisoning, osteomyelitis, pyoarthritis, endocarditis, toxic shock syndrome, and a broad spectrum of other disorders (Todd 1998, Hajjeh et al. 1999, Rubin et al. 1999). In recent years, there has been an alarming increase in nosocomial staphylococcal infections by strains with multiple drug resistance (Al-Masaudi et al. 1991, Kloos and Bannerman 1995, Hiramatsu et al. 1997). At present, this situation is leading to the evaluation of staphylococcal pathogens potentially resistant to any available antibiotic (Noble et al. 1992, Huycke et al. 1998, Rubin et al. 1999).

The point of the treatment of nosocomial infections, it was a consequential decision. Therefore, this result may suggest that the ethanolic extracts of the species posses compounds with antimicrobial properties which can be used as antimicrobial agents in new drugs for therapy of infectious diseases in human.

ACKNOWLEDGEMENTS

This work is a part of Nurdan Sarac's Master of Science Thesis.

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Mugla, Turkiye'de Yetisen Bazi Lamiaceae Turlerinin Antimikrobiyal Aktiviteleri ve Halk Tababeti'nde Kullanimlari

Ozet

Bu calismada; Lamiaceae familyasina dahil ve geleneksel tedavide kullanilan 23 bitki turu, Mugla'nin farkli yorelerinden toplanmis, kurutulmus ve sokslet ekstraksiyon aparatinda etanol ile ekstrakte edilmistir. Bitki ekstraktlarinin antimikrobiyal aktiviteleri, antibiyotiklere coklu direncli bakterilerin de dahil oldugu cesitli test mikroorganizmalari uzerinde arastirilmistir. Ekstraktlarin antimikrobiyal aktiviteleri disk difuzyon metodu ile belirlenmistir. Test mikroorganizmalari olarak; 7 Gram pozitif, 7 Gram negatif bakteri ve *C. albicans* secilmistir. Ayrica inhibisyon zonlarinin karsilastirilmasi amaciyla cesitli standart antibiyotik diskleri kullanilmistir. *S. verbenaca*, *T. chamaedrys* ssp*. lydium, T. divaricatum* ssp*. villosum, T. polium, S. annua* ssp*. annua* var*. annua, S. albiflora, S. leptoclada* ve *P. vulgaris*'e ait etanolik ekstraktlarin antimikrobiyal aktiviteleri, antibiyotiklere coklu direncli Staphylococcus suslarinin da dahil oldugu Gram pozitif bakterilere karsi belirlenmistir. *S. leptoclada*'ya ait etanolik ekstrakt en yuksek inhibisyon etkisine sahiptir. Buna karsin tum bitkilere ait etanolik ekstraktlar Gram negatif bakteriler ve *C. albicans* uzerinde etkisizdir. Bakteriler uzerinde inhibisyon etkisi gosteren etanolik ekstraktlar *S. aureus* ATCC 25923, MU 38, MU 44 ve *S. epidermidis* uzerinde daha etkilidir. *S. leptoclada*'nin *S. aureus* ATCC 25923 uzerindeki inhibisyon zonu ayni bakteri uzerindeki oksasilinin inhibisyon zonundan daha yuksektir.

Anahtar Kelimeler: Antibiyotik direncli bakteri, antimikrobiyal aktivite, halk tababeti, Lamiaceae.

