

# Antimicrobial Activity of Some *Verbascum* Species Growing in Turkey

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## Antimicrobial Activity of Some *Verbascum* Species Growing in Turkey

### Summary

The antimicrobial activities of methanol extracts of seven *Verbascum* species were studied. The dried extracts of the aerial parts of *Verbascum dudleyanum* (Hub.-Mor.) Hub.-Mor., *V. latisepalum* Hub.-Mor., *V. mucronatum* Lam., *V. olympicum* Boiss., *V. stachydifolium* Boiss. & Heldr. and *V. uschackense* (Murb.) Hub.-Mor., the flowers of *V. lasianthum* Boiss. were tested against standard bacterial strains of *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853), *Staphylococcus aureus* (ATCC 29213), *Enterococcus faecalis* (ATCC 29212), and standard fungal strains of *Candida albicans* ATCC 90028, *Candida parapsilosis* ATCC 90018 and *Candida krusei* ATCC 6258 by disc diffusion methods, which were recommended by Clinical and Laboratory Standards Institute. While *V. mucronatum* Lam. and *V. olympicum* Boiss. showed an antibacterial activity against gram positive bacteria, and *S. aureus* as well as *V. latisepalum* Hub.-Mor. showed an antifungal activity against *C. krusei*. The other species had no activity.

**Key Words:** *Verbascum dudleyanum*, *V. lasianthum*, *V. latisepalum*, *V. mucronatum*, *V. olympicum*, *V. stachydifolium*, *V. uschackense*, Scrophulariaceae, Antimicrobial Activity.

Received: 20.04.2012

Revised: 20.09.2012

Accepted: 27.09.2012

## Türkiye’de Yetişen Bazı *Verbascum* Türlerinin Antimikrobiyal Aktiviteleri

### Özet

Yedi *Verbascum* türünün metanol ekstraktlarının antimikrobiyal aktivitesi çalışılmıştır. *Verbascum dudleyanum* (Hub.-Mor.) Hub.-Mor., *V. latisepalum* Hub.-Mor., *V. mucronatum* Lam., *V. olympicum* Boiss., *V. stachydifolium* Boiss. & Heldr., *V. uschackense* (Murb.) Hub.-Mor.’un topraküstü; *V. lasianthum* Boiss.’un çiçekli kısımlarının metanol ekstraktları, standart bakteri suşları *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 27853), *Staphylococcus aureus* (ATCC 29213), *Enterococcus faecalis* (ATCC 29212) ve standart mantar suşları olan *Candida albicans* ATCC 90028, *Candida parapsilosis* ATCC 90018 ve *Candida krusei*’ye karşı, Klinik ve Laboratuvar Standartları Kurumu’nun önerdiği disk difüzyon metodu ile test edilmiştir. *V. mucronatum* Lam. ve *V. olympicum* Boiss. gram pozitif bakteri *S. aureus*’a karşı antibakteriyel, *V. latisepalum* Hub.-Mor. ise *C. krusei*’ye karşı antifungal aktivite gösterirken, diğer türler herhangi bir aktivite göstermemiştir.

**Anahtar Kelimeler:** *Verbascum dudleyanum*, *V. lasianthum*, *V. latisepalum*, *V. mucronatum*, *V. olympicum*, *V. stachydifolium*, *V. uschackense*, Scrophulariaceae, Antimikrobiyal Aktivite

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## INTRODUCTION

The genus *Verbascum*, commonly known as “mullein”, is a widespread genus of the family Scrophulariaceae, which comprises more than 2500 species worldwide. This taxon is represented by 233 species, 196 of which are endemic, in the flora of Turkey (1-3). Some *Verbascum* species have been used for their medicinal effects in Turkey. Their flowers have mucolytic and expectorant effects, and the leaves have been used as diuretic, sudorific, expectorant, sedative and antidiarrheic in traditional Turkish medicine (4). Turker and Camper showed that *K. pneumoniae* and *S. aureus* showed sensitivity to the Mullein, which may explain why Mullein is used in folk medicine to treat respiratory disorders (caused by *K. pneumoniae* and *S. aureus*) and urinary tract infections (caused by *K. pneumoniae*) (5).

Antiviral, antimicrobial, antimalarial, antioxidant, anti-inflammatory, antinociceptive, antitumor, anticancer, cytotoxic, immunomodulatory, antiulcerogenic, antihepatotoxic, antihyperlipidemic, antitussive and antigermination activities of *Verbascum* species have been previously reviewed (6).

This study is aimed to investigate the potential antimicrobial activity of *Verbascum* species growing in Turkey against bacterial and fungal strains.

## MATERIALS and METHODS

### Plant materials

Plant materials were collected from different region of Turkey during the flowering time. The voucher specimens were deposited in the herbarium of the Faculty of Pharmacy, Hacettepe University and Faculty of Science, Gazi University, Ankara, Turkey.

*Verbascum dudleyanum* (Hub.-Mor.) Hub.-Mor : Burdur, South shore of Lake Salda, wet locations by the lake, alt. 1170 m (HUEF 02001)

*Verbascum lasianthum* Boiss. ex Bentham: Izmir, Urla, Ucahirlar (HUEF 99139)

*V. mucronatum* Lam.: Aksaray, Aksaray to Ulukışla, 17<sup>th</sup> km (GAZI 10097)

*Verbascum latisepalum* Hub.-Mor. : Burdur, Burdur to Cavdir, *Pinus brutia* forest, alt. 800 m (HUEF 02007).

*Verbascum olympicum* Boiss.: Bursa, Uludağ, 1800 m (GAZI 10135)

*Verbascum stachydifolium* Boiss. & Heldr : Konya, from Konya to Ankara, 65 km N. of Konya, alt. 900 m (GAZI 10165)

*Verbascum uschackense* (Murb.) Hub.-Mor.: Afyon, 5 km from Afyon to Konya, alt. 700–800 m (GAZI 10121)

### Preparation of the plant materials

Seven samples of air dried parts (the aerial parts and the flowers) of the plants were extracted with methanol using an evaporator without any vacuum, at room temperature. Extracts were filtered and the combined MeOH extracts were concentrated under reduced pressure at 40°C, and were stored at –20°C for further analyses. Each of the plant extracts were dissolved in methanol and used in the antimicrobial assay.

### Antimicrobial assay

Antibacterial and antifungal activities were determined using the disc diffusion test method as recommended by Clinical and Laboratory Standards Institute (7,8). Plant extracts were tested against three bacteria including one Gram positive (*Staphylococcus aureus* ATCC 29213) and two Gram negative microorganisms (*Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853) as well as for antifungal activities against three yeasts (*Candida albicans* ATCC 90028, *Candida krusei* ATCC 6258, *Candida parapsilosis* ATCC 90018). The inoculum densities were approximately 0.5 McFarland ( $1.5 \times 10^8$  cfu/mL) for bacteria and fungi, respectively. Antibacterial activity test was performed on a Mueller-Hinton Agar (MHA, Difco, USA). Mueller-Hinton Agar plus 2% glucose and 0.5 µg/mL methylene blue dye (GMB) was used as the culture medium for antifungal activity test. Empty sterilized discs of 6 mm in diameter with 20 µl capacity (Schleicher&Shüll No: 2668, Germany) were impregnated with the dissolved extracts and

dried in room temperature. The bacteria and fungi strains were inoculated on MHA and GMB agar surfaces homogenously, using sterile swabs. The discs were placed on the inoculated agar plates and were incubated overnight at 37°C. The inhibition zones around the discs were measured in millimeters. Ciprofloxacin and fluconazole were used as reference compounds for bacteria and fungi, respectively.

**RESULTS and DISCUSSION**

The antimicrobial activity results of the *Verbascum* species against standard strains of Gram positive, Gram negative bacteria and fungi were given in Table I. As can be seen in table 1, *V. mucronatum* and *V. olympicum* showed antibacterial activity against *S. aureus*, a gram positive bacteria, and *V. latisepalum* showed antifungal activity against *C.krusei*, however, none of the other extracts had inhibition zones.

Antimicrobial activities of *V. qulebriu* (9), *V. blattaria*, *V. bombyciferum*, *V. chaixii*, *V. dumulosum*, *V. nigrum*, *V. olympicum*, *V. phlomoides*, *V. phoeniceum* and *V. roripifolium* (10), *V. sinaiticum* (11), *V. macrurum* (12) have been demonstrated previously." Additionally, antimicrobial activities of *V. olympicum*, *V. prusianum*, and *V. bombyciferum* have been investigated against *Escherichia coli* ATCC 11230, *Micrococcus luteus* La 2971, *Staphylococcus aureus* ATCC 6538P, *Salmonella thyphi* ATCC 19430, *Klebsiella pneumoniae* UC57, *Pseudomonas aeruginosa* ATCC 27893, *Corynebacterium xerosis* CCM 2824, *Bacillus cereus* ATCC 7064, *Bacillus megaterium* DSM 32, *Mycobacterium smegmatis* CCM 2067, *Proteus vulgaris* ATCC 8427, *Candida albicans* ATCC 10231, *Rhodotorula rubra*, and *Saccharomyces cerevisiae* ATCC 9763 using the agar disc diffusion method (12). *Verbascum* L. species showed antimicrobial activity against the Gr(+) bacteria such as *Micrococcus*

**Table 1.** Table 1: In vitro antimicrobial activity of the *Verbascum* species by disc diffusion method

Plant Extracts	Zones of inhibition (mm)					
	Bacteria			Fungi		
	<i>S. aureus</i> ATCC 29213	<i>E. coli</i> ATCC 25922	<i>P. aeruginosa</i> ATCC 27853	<i>C. albicans</i> ATCC 90028	<i>C. krusei</i> ATCC 6258	<i>C. parapsilosis</i> ATCC 90018
<i>V. dudleyanum</i> (924 µg/20µl)	x	x	-	-	-	-
<i>V. lasianthum</i> 200 µg/20 µl	x	x	-	x	x	x
<i>V. latisepalum</i> 1097 µg/20 µl	x	x	x	x	11	x
<i>V. mucronatum</i> 1133 µg/20 µl	9/10	x	x	x	x	x
<i>V. uschackense</i> 1102 µg/20 µl	x	x	x	x	x	x
<i>V. stachydifolium</i> 1020 µg/20 µl	x	x	x	x	x	x
<i>V. olympicum</i> 1086 µg/20 µl	11/11	x	x	x	x	x
Ciprofloksasin	25	31/32	35	-	-	-
Fluconazole	-	-	-	30	x	24

x = No inhibition zone, - = Not tested

*luteus* La 2971, *Staphylococcus aureus* ATCC 6538P and yeasts such as *Candida albicans* ATCC 10231, but no activity was observed against the Gr(-) bacteria used in that study such as *Escherichia coli* ATCC 11230 and *Pseudomonas aeruginosa* ATCC 27893 (13). Moreover, the methanol extracts of *V. gypsicola*, *V. protractum*, *V. bellum*, *V. dalamanicum*, *V. pseudoholotrichum*, *V. cymigerum*, *V. cholorostegium*, *V. linguifolium*, *V. pel-litum*, *V. chionophyllum*, *V. cilicium*, *V. trapifolium*, *V. meinckeanum*, *V. lyratifolium*, *V. vacillans*, *V. carinense*, *V. adenophorum* and *V. inulifolium* have been found to be effective against gram positive bacteria and the yeast, but no activity observed against gram negative bacteria by disc-diffusion method (14-19). As a result of these studies *Staphylococcus aureus* and the yeast cultures appear to be more susceptible to plant extracts. We also obtained similar results in our research.

## CONCLUSION

In conclusion, this study presents the antimicrobial activities of *Verbascum dudleyanum*, *V. lasianthum*, *V. latisepalum*, *V. mucronatum*, *V. olympicum*, *V. stachydifolium* and *V. uschackense*. *Verbascum* species contain biologically active compounds, such as flavonoids, phenylethanoid and neolignan glycosides, saponins, and iridoid glycosides (20). Therefore, further studies are required in order to clarify the bioactive principles responsible of these activities.

## ACKNOWLEDGEMENT

The authors thank Prof. Dr. Hayri Duman, Gazi University, Faculty of Science, Department of Botany, Etiler, Ankara, Turkey, for authenticating the plant specimens.

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