ARIŞTIRMA-Apicultural Research Araştırma Makalesi-Research Article

ANTIMICROBIAL ANALYSIS OF PROPOLIS SAMPLES FROM DIFFERENT REGIONS IN TURKEY

Türkiye'nin Farkli Coğrafik Bölgelerinden Toplanan Propolis Örneklerinin Antimikrobiyel Analizi

[1]Sibel SİLİCİ, [2]Osman KAFTANOĞLU

[1] Department of Animal Health, Safiye Cikrikcioglu Vocational College, Erciyes University, Kayseri-Turkey, E-mail: silicis@erciyes. edu. tr
[2] Department of Animal Science, Faculty of Agriculture, Çukurova University, Adana- Turkey

Abstract: Propolis (bee glue) is a resinous material which honey bees make by collecting material (*A. mellifera L.*) from plants and mixing it with beeswax. Propolis is used to reduce the entry of air into the hive and to enforce the thin sides of the frame. Propolis is used in folk medicine, apitherapy, cosmetics and the pharmaceutical industry for varies purposes because of reported antibacterial, antiviral and antifungal properties and anti-inflammatory properties. In this research the antibacterial activity of propolis collected from the different regions of Turkey is investigated. Antibacterial activity was assayed using *S. aureus* and *E. coli.* All of the propolis samples exhibited activity against *S. aureus* while the antibacterial activity against *E. coli* was found to be weaker.

Key Words: Propolis, antibacterial activity, *S. aureus, E. coli*

Özet: Propolis (arı yapışkanı) bal arılarının (*Apis mellifera L.*) bitkilerin canlı kısımlarından topladıkları, mumla karıştırıp yuvalarının yapımı ve adaptasyonunda kullandıkları yapışkan koyu renkli reçinemsi bir materyaldir. Propolis savunmayı kolaylaştırmak için yada kovan girişinden hava girişini azaltmak için, çerçevelerin ince kenarlarını güçlendirmek ve tamir etmek için, çatlak ve yarıkları kapatmak için kullanılmaktadır. Bal arıları propolisin mekanik ve biyolojik özelliklerinden çok iyi faydalanmaktadır; örneğin kovan içinde öldürülen ancak kovan dışına taşınamayan düşmanları mumyalayarak çürümesini önlenmektedir. Propolis, antibakteriyel, antifungal ve antiviral özellikleriyle birlikte antiinflammatör, antiülser, lokal anestetik, antitümör, immünostimülatör gibi biyolojik aktiviteleri nedeniyle popüler bir ilaç olarak halk tıbbında, apiterapide, biokozmetikte ve ilaç sanayiinde çeşitli amaçlarla kullanılmıştır. Bu araştırmada Türkiye'nin farklı coğrafik bölgelerine ait illerden (Bursa, İzmir, Kayseri, Sivas, Yozgat, Erzurum, Hatay, Artvin) toplanan propolis örneklerinin *S. aureus ve E. coli* bakterilerine karşı anitibakteriyel aktivitelerini incelenmiştir. İncelenen propolis örneklerinin tümü *S. aureus*'a karşı önemli aktivite gösterirken, *E. coli*'ye karşı gözlenen antibakteriyel aktivite daha zayıf bulunmuştur.

Anahtar Kelimeler: Propolis, antibakteriyel aktivite, *S. aureus, E. coli*

INTRODUCTION

Propolis is a mixture of wax and resin which are collected by honey bees (*A. mellifera L.*). Propolis has very important functions in the beehive. It is used for closing the holes and cracks in the hive, for making the entrance hole smaller, and for covering the insects which die in the hive that cannot be taken out due to their size. Propolis, contains 45-55% resin, 25-35% wax and fatty acids, 5% pollen, 5% other organic substances and minerals. Ethanolic extracts of propolis contain flavanoids, flavanons, aliphatic acids and their esters, alcohols, aldehydes, calcons, dihydrocalcons, ketones, terpenoids, and many other biologically active substances (Bankova et al., 1999).

Antibacterial (Kujumgiev et al., 1999; Sforcin et al., 2000), antifungal (Sforcin et al., 2000; Ota et al., 2001), antiviral (Kujumgiev et al., 1999), antioxidant (Hayashi et al., 1999), anti inflammator (Öztürk et al., 1999), cytotoxic (Banskota et al., 1998), antioxidan (Mıtamura et al., 1996) and immunomodulator (Dimov et al., 1991) properties of propolis have been reported. However the chemical properties of propolis vary according to the climate and vegetation of the region. Thus, the reported medicinal properties of propolis may vary as well. The aim of this study was to define the antibacterial properties of propolis collected from different geographical regions of Turkey in order to test that theory.

MATERIAL AND METHOD

Propolis samples collected from 9 different regions of Turkey (Erzurum, Bursa, İzmir, Adana, Hatay, Kayseri, Sivas, Yozgat, Artvin) for the study. Turkey is composed of seven different geographical regions. Geographic regions in Turkey show diverse climatic and geomorphological features. Therefore, there are different flora at each region. Propolis samples are collected from

all of these different regions, which had different geographical origins. All of the propolis samples are collected from stationary apiaries, *A mellifera* colonies.

Extracts of each sample were made using 80 % ethanol. The microorganisms chosen to assay antimicrobial activity were *Staphylococcus aureus ATCC 29213* and *E. coli ATCC* 25922. Serial dilutions of the Propolis extracts were prepared using the agar dilution method according to the NCCLS guidelines (1997). Extract concentrations were from 0. 1% to 14. 0 % were tested for antibacterial activity. Non parametric Friedman test was used for the statistical analysis of the antibacterial properties of propolis.

RESULTS

The antibacterial activity of propolis defined by agar dilution method is shown in Table 1. All of the propolis samples show antibacterial activity and there isn't a statistically significant difference between the antibacterial activities (P>0.05). Bursa and Sivas propolis samples have the highest antibacterial activities. Yozgat, Kayseri, Adana, İzmir, Hatay, Erzurum and Artvin propolis samples follow these in antibacterial activity.

Among the tested bacteria species, the antibacterial activity is higher against *S. aureu*s which is Gram positive. *E. coli*, which is Gram negative, shows more resistance to propolis samples at different concentrations.

Table 1. Antibacterial activity of propolis samples ($MİK_{50}$, $MİK_{90}$; the minimum inhibitory concentrations of propolis to 50% to 90% of the bacteria species

Bacterial species	Yozgat	Sivas	Artvin	Adana	Kayseri	Bursa	Erzurum	Hatay	İzmir
E. coli ATCC 25922 (n=6)									
$MİK_{50}$	7.0	3.5	14.0	14.0	7.0	3.5	>14.0	7.0	7.0
$MİK_{90}$	14.0	7.0	>14.0	>14.0	14.0	3.5	>14.0	14.0	14.0
S. aureusATCC25923(n=5)									
$MİK_{50}$	<0.1	<0.1	0.2	<0.1	0.2	<0.1	0.4	0.2	<0.1
$MİK_{90}$	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	0.4	0.4	<0.1

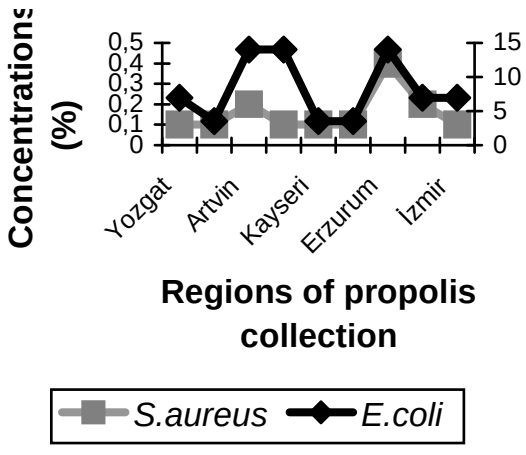

Figure 1. *Antibacterial activity of propolis (against S. aureus and E. coli)*

DISCUSSION

The antibacterial activity of propolis was tested with samples collected from different geographical regions of the world and this property is attributed to esters, aromatic acids, flavonoids (Marcucci et al., 2001), caffeic acid and its esters (Garcia-Viguera, 1992), cinnamic acids (Ikeno et al., 1991), caffeic acid phenyl ester (Bosio et al., 2000), pinobanxin, pinobanxin-3-asetat (Metzner et al., 1979), evaporating compounds and diterpenic acids (Bankova et al., 2000), furofuranlignans (Bankova et al., 1999) phenolic acids and their esters (Ghisalberti, 1979). However, many researchers (Amaros et al., 1994; Bonvehi and Coll, 1994; Kujumgiev et al., 1999) have stated that a special substance class or a unique substance is not responsible for the antibacterial activity of propolis, instead of this different compounds with different combinations is required for the biological activity of propolis, and that a component of propolis extract cannot have a strong activity as the total propolis extract.

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