

Analysis of the bactericidal activity of honey

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Abstract. The work is devoted to the study of the antibacterial properties of various types of honey. The authors conducted studies of the bactericidal activity of honey collected in different regions of Russia. Based on the research conducted, the authors drew conclusions about the prospects of using beekeeping products in the development of antimicrobial drugs and biologically active additives based on natural raw materials.

1 Introduction

The World Health Organization calls for scientific attention to be focused on the emergence of resistant strains of *Pseudomonas aeruginosa* and *Staphylococcus aureus* that are insensitive to methicillin and vancomycin. The list of microorganisms that are drug resistant to synthetic and semi-synthetic antibiotics continues to grow [9]. In this regard, the development of antimicrobial drugs based on natural medicinal raw materials of both plant and animal origin is becoming increasingly important. Thus, studying the bactericidal activity of different varieties of honey is a promising area of research.

2 Materials and methods

The object of the study is honey samples collected in different regions of Russia.

The subject of the study is the effect of the active components of honey on bacterial test cultures.

The purpose of the study was to analyze the bactericidal activity of honey samples against bacterial test cultures.

The bactericidal activity of selected honey samples was assessed using standard test strains of *Pseudomonas aeruginosa*, *Bacillus cereus*, *Escherichia coli*, *Staphylococcus aureus*. The antimicrobial activity of different types of honey was assessed in accordance

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with General Pharmacopoeia article 1.2.4.0010.18 “Determination of antimicrobial activity of antibiotics by diffusion into agar. Order of the Ministry of Health of the Russian Federation” [7].

3 Results

To study the bactericidal activity, six varieties of honey with conditional numbers from M1 to M6 were prepared (Figure 1): M1 - White Acacia (Krasnodar), M2 - Chestnut tree (Krasnodar), M3 - Buckwheat (Oryol), M4 - Linden Tree (Primorye), M5 - Linden Tree (Krasnodar), M6 - Wild grasses (Ryazan).

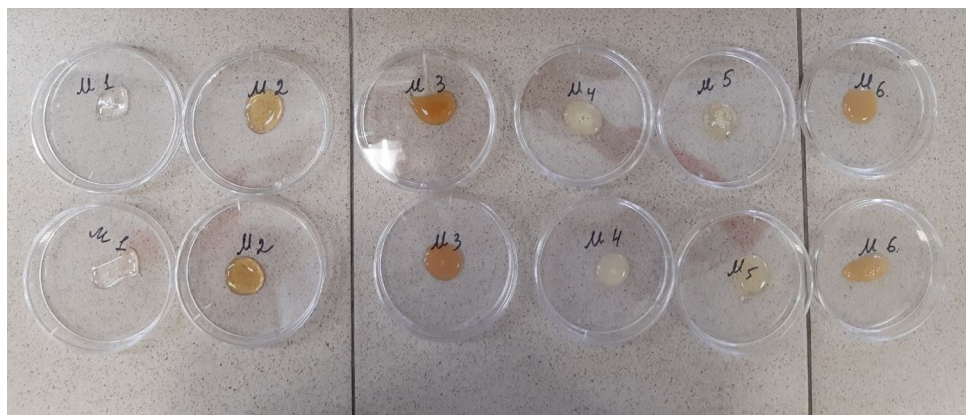


Fig. 1. Tested honey samples.

Organoleptic evaluation of the samples was carried out on a five-point scale from 1 to 5. The maximum possible evaluation score for four organoleptic parameters is 20.

Quality category rating scale:

- From 16 to 20 points – a high quality product.
- From 10 to 15 points – a product of satisfactory quality.
- Less than 10 points – product of unsatisfactory quality.

The arithmetic average of the expert group's assessments is presented in Table 1.

Table 1. Results of organoleptic evaluation of honey samples.

Sample	Honey variety	Smell	Taste	Color	Consistency	Points
M1	White Acacia (Krasnodar)	5	4	5	5	19
M2	Chestnut tree (Krasnodar)	4	2	5	5	16
M3	Buckwheat (Oryol)	3	4	5	4	16
M4	Linden Tree (Primorye)	5	5	5	4	19
M5	Linden Tree (Krasnodar)	4	4	5	4	17
M6	Wild grasses (Ryazan)	4	4	5	4	17

As the analysis shows, all presented honey samples are high-quality products. The highest scores according to the results of the organoleptic evaluation were obtained by honey varieties M1 - White Acacia (Krasnodar) and M4 - Linden Tree (Primorye).

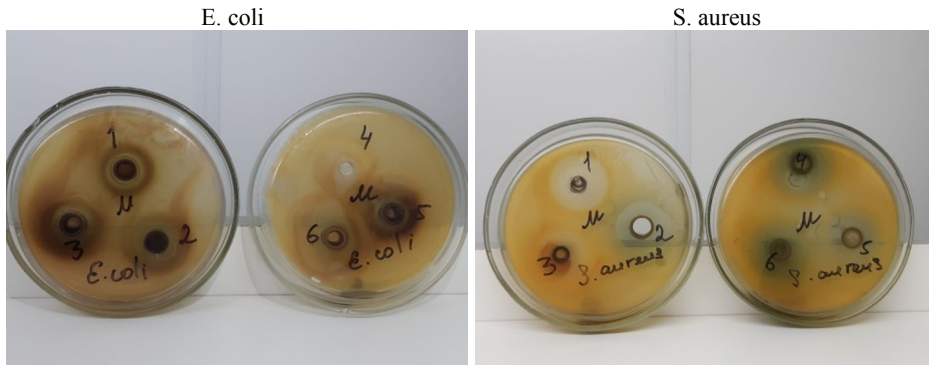
The results of studies of the bactericidal activity of different varieties of honey on nutrient media inoculated with test strains of *Pseudomonas aeruginosa*, *Bacillus cereus*, *Escherichia coli* and *Staphylococcus aureus* are presented in Table 2.

Table 2. Results of studying the bactericidal activity of honey samples.

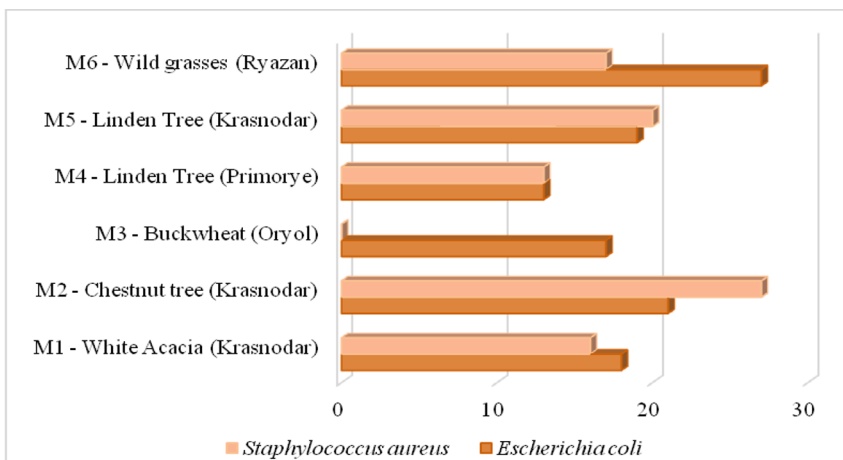
Sample	Honey variety	Diameter of the bactericidal zone, mm			
		<i>Pseudomonas aeruginosa</i>	<i>Bacillus cereus</i>	<i>Escherichia coli</i>	<i>Staphylococcus aureus</i>
M1	White Acacia (Krasnodar)	0*	0*	18	16
M2	Chestnut tree (Krasnodar)	0*	0*	21	27
M3	Buckwheat (Oryol)	0*	0*	17	0*
M4	Linden Tree (Primorye)	0*	0*	13	13
M5	Linden Tree (Krasnodar)	0*	0*	19	20
M6	Wild grasses (Ryazan)	0*	0*	27	17

* Suppression of the growth of microorganisms is expressed only under the cylinder

Analysis of the data showed that the bactericidal activity of the studied honey varieties appeared only against *Escherichia coli* and *Staphylococcus aureus* (Figure 2).

**Fig. 2.** Bactericidal activity of honey samples.

The samples M6 - Wild grasses (Ryazan) and M2 - Chestnut tree (Krasnodar) have the maximum bactericidal activity against *Escherichia coli*, the diameter of the zone of bactericidal action of which is 27 and 21 mm, respectively.

**Fig. 3.** Diameter of the zone of inhibition of bacterial growth as a result of exposure to different types of honey.

The maximum bactericidal effect on *Staphylococcus aureus* was exerted by honey varieties M2 - Chestnut tree (Krasnodar) and M5 - Linden Tree (Krasnodar), the diameter of the zone of suppression of microorganism growth was 27 and 20 mm, respectively.

4 Discussion

Issues related to the study of the antibacterial properties of honey were considered in the works of such authors as: Abuelgasim, Albury, Lee [1], Almasaudi [2], Brudzynski [3-4], Leiva-Sabadini [10]. The antioxidant properties of honey have been reviewed in the works of Brudzynski [5], Freitas [6], [8] and other authors.

5 Conclusion

The results obtained based on the research carried out allow us to conclude that all presented honey samples are high-quality products. According to the results of the organoleptic assessment, the varieties M1 – White Acacia (Krasnodar) and M4 – Linden Tree (Primorye) scored the highest.

Almost all varieties of honey showed bactericidal activity against *Staphylococcus aureus* and *Escherichia coli*. To the maximum extent, the reproduction of *Staphylococcus aureus* is suppressed by honey M2 - Chestnut tree (Krasnodar), and the growth of *Escherichia coli* was most clearly influenced by the variety M6 - Wild grasses (Ryazan).

The studied varieties of honey have virtually no effect on the proliferation of bacteria *Pseudomonas aeruginosa* and *Bacillus cereus*, having a bactericidal effect only under the cylinder.

In general, the pronounced bactericidal activity of different varieties of honey against *Escherichia coli* and *Staphylococcus aureus* (with the exception of sample M3 - Buckwheat) allows us to conclude that the use of beekeeping products is promising in the development of antimicrobial drugs and biologically active additives based on natural raw materials.

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