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ORGANOLEPTIC AND PHYSICOCHEMICAL QUALITY INDICATORS OF HONEY FROM BEE COLONIES AFFECTED BY VARROATOSIS

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Annotation: This study investigates the impact of Varroa destructor infestation on the quality of honey produced by healthy and varroatosis-affected bee colonies. Honey samples were collected from different apiaries, and organoleptic, physicochemical, microbiological, and toxicological parameters were evaluated. Results show that honey from healthy colonies exhibits light-yellow to medium-yellow color, sweet taste, and optimal consistency, while honey from varroa-infested colonies is darker, slightly bitter, and less viscous. These changes are linked to impaired bee physiology, reduced metabolic and enzymatic activity, and accelerated fermentative processes. The study highlights the importance of controlling varroatosis to maintain honey quality and consumer safety.

Keywords: Honey quality, Varroa destructor, Varroatosis, Apiculture, Organoleptic properties, Physicochemical analysis, Bee health, Metabolic activity, Enzymatic activity, Parasite impact, Consistency, Color, Taste, Apiary, Food safety

Introduction: Beekeeping is one of the oldest human practices, playing a crucial role not only in ensuring food security but also in maintaining ecological balance. Honey, beeswax, propolis, and other bee products hold exceptional importance for human health due to their high biological value, medicinal properties, and versatile applications. In particular, honey is valued as a natural source of energy, a substance with antibiotic effects, and an immune-strengthening agent. Therefore, monitoring the quality and safety of honey is a priority area of veterinary-sanitary expertise.

Currently, one of the most harmful parasitic diseases affecting beekeeping is varroatosis. The causative agent of this disease is the mite Varroa destructor, which feeds on the hemolymph of bees, disrupting their physiological functions and significantly weakening their immunity. As a result, bee colonies become more susceptible to viral, bacterial, and fungal diseases, which indirectly affects the quality parameters of honey. Studies have shown that honey obtained from colonies infested with varroatosis may exhibit certain chemical changes, reduced enzymatic activity, and deviations in microbiological indicators from standard norms.

Relevance of the Study: In Uzbekistan, varroatosis is widespread and is recognized as one of the main factors reducing beekeeping productivity. Ensuring stable growth in honey production, making it competitive in both domestic and international markets, and protecting public health make it a pressing task to conduct an in-depth veterinary-sanitary examination of honey obtained from colonies infested with varroatosis.

Research Results: Alongside the epizootological analysis of varroatosis in honey bees, honey samples were collected from colonies exhibiting healthy and disease symptoms across apiaries located in various agroclimatic zones to assess their veterinary-sanitary status. From each

experimental and control group, 50–100 worker bees and 100–150 grams of honey were collected per colony, and an average of 0.5–1.0 kg of honey per apiary was gathered in sterile, clean containers according to hygienic requirements and transported to the laboratory. Laboratory analyses were conducted to evaluate organoleptic, physicochemical, microbiological, and toxicological parameters of the collected honey samples.

During the study, the organoleptic properties of the honey—color, aroma, taste, and consistency—were assessed as key indicators of quality and suitability for consumption. The external appearance and quality of the honey are considered primary criteria in veterinary-sanitary expertise.

Color indices of honey depend on its origin, chemical composition, and storage conditions, providing a rapid visual assessment method. In this experiment, the color of honey samples from healthy and varroatosis-affected bees was determined using visual inspection and sensory evaluation. Assessment was conducted in glass containers under natural lighting on a white background. The color indices were compared according to the standard color chart GOST 19792–2001.

Honey from healthy bees mostly exhibited light-yellow to dark-yellow hues, with uniform clarity, which is characteristic of honey derived from flower sources under clean physiological conditions. In contrast, honey from varroatosis-affected bees ranged from dark yellow to dark brown, with occasional slight cloudiness. These changes are attributed to the effect of the parasite on bee physiology and accelerated enzymatic processes during storage.

1-table

Comparison of Color Indices and Visual Appearance of Honey from Healthy and Varroatosis-Affected Bees

Honey Source	Color Indices (GOST)	Visual Description	Notes
Honey from healthy bees	25–45 units	Light yellow – dark yellow	Clear, uniform, distinct shine
Honey from varroatosis-affected bees	50–80 units	Dark yellow – dark brown	Slightly cloudy in some cases, somewhat thicker consistency

According to the requirements of the GOST state standards, honey with color indices in the range of 25–50 units is considered high-quality and suitable for consumption. Honey within this range is typically light yellow to medium yellow, characterized by clarity, uniformity, and a distinctive shine. Such color values indicate that natural fermentative processes in the honey occurred normally, oxidation products are absent, and there are no external impurities.

Experimental results showed that honey samples from healthy bee colonies had color indices ranging from 25 to 45 units. These values fully comply with current GOST standards and confirm the high quality of the honey. Organoleptically, these samples ranged from light yellow to dark yellow, exhibiting clarity, shine, and uniformity. These characteristics further confirm the naturalness and high consumer value of honey collected from healthy colonies.

In contrast, honey samples from varroatosis-affected colonies had color indices ranging from 50 to 80 units. These values exceed the GOST standard and indicate significant changes in honey quality. Organoleptic evaluation revealed colors from dark yellow to dark brown, with some samples appearing slightly cloudy and having a thicker consistency. This condition reflects the

negative impact of Varroa parasite infestation on the physicochemical processes in honey, resulting in a decrease in honey quality.

Overall, honey from healthy colonies met GOST standards and was assessed as a high-quality product, whereas honey from varroatosis-affected colonies deviated from the norm, scientifically confirming the direct negative effect of the disease on honey quality.

Changes in Fermentative Activity: Healthy bees produce enzymes responsible for sweetness and the floral aroma of honey at a normal level. In bees affected by varroatosis, metabolic activity decreases, leading to a reduction in the natural aroma of honey or the appearance of foreign, slightly sour odors.

Parasitic Effect: Varroa destructor feeds on the bees' hemolymph, disrupting their normal physiological functions. As a result, changes occur in the honey composition: the ratio of phenolic compounds, organic acids, and aromatic substances alters, which affects the aroma.

Subsequent experiments were conducted to evaluate the taste and consistency of the collected honey samples. Honey from healthy and varroatosis-affected bees was used. For each group, three containers were prepared, each containing 50 g of honey.

The evaluation was carried out individually by three experienced experts. Each expert assessed the taste and consistency of each sample separately.

The taste scoring criteria were as follows:

- Sweet, natural – 5 points
- Slightly sour – 3–4 points
- Sour, bitter, or foreign – 1–2 points

For consistency:

- Good, appropriate viscosity – 5 points
- Slightly too hard or too soft – 3–4 points
- Very hard or very liquid – 1–2 points

The average score was calculated based on the ratings given by each expert, and the results were presented in the following table. This experimental methodology allowed a scientific comparison of the organoleptic quality of honey obtained from healthy and varroatosis-affected bees.

2-table

Comparison of Taste and Consistency of Honey Samples Obtained from Healthy and Varroatosis-Affected Bees

Honey Type	Taste (Expert Scores)	Average Taste	Consistency (Expert Scores)	Average Consistency	Note
Sample from healthy bees	4, 5, 4	4.3	4, 4, 4	4.0	Sweet, natural taste; proper consistency
Sample from varroatosis-affected bees	4, 2, 3	3.0	3, 4, 3	3.33	Slightly sour taste; lower consistency

The honey samples obtained from healthy and varroatosis-affected bee colonies were evaluated organoleptically for taste and consistency. The taste of honey from healthy bees was sweet and natural, with expert scores ranging from 4 to 5 points, averaging 4.3 points. Its consistency was proper and optimal, receiving an average score of 4 points. These results indicate that healthy bees maintain normal fermentative and metabolic activity, as well as a balanced composition of sugars and aromatic compounds in the honey.

Honey from varroatosis-affected bees had a slightly sour taste, with expert scores ranging from 2 to 4 points and an average of 3.0 points. Its consistency was lower than that of honey from healthy bees, with an average score of 3.33 points. This reflects the negative impact of the Varroa destructor parasite on the bees' metabolic and fermentative activity, leading to changes in sugar and aromatic compound ratios and a decline in the organoleptic quality of the honey.

The results demonstrate that the organoleptic properties of honey from varroatosis-affected bees are significantly worse than those from healthy colonies. The slightly sour taste is primarily due to the physiological stress and reduced nectar-gathering activity of parasitized bees, which hinders complete fermentative processing of nectar and lowers the honey's sweetness. Changes in consistency are associated with moisture content and sugar degradation, which become unstable under varroatosis conditions; in some cases, the honey may darken or appear cloudy.

Thus, honey from healthy bees is high-quality, sweet, and optimally consistent, whereas honey from varroatosis-affected bees is inferior in taste and consistency, confirming that varroatosis can significantly deteriorate honey quality. This, in turn, reduces its marketability and consumer acceptability. These findings scientifically demonstrate the negative impact of varroatosis on the organoleptic characteristics of honey, highlighting the necessity of regular and effective varroatosis control measures to maintain honey quality.

Conclusions:

1.Varroa destructor infestation significantly alters the organoleptic properties of honey, reducing taste and consistency quality.

2.Honey from healthy bee colonies meets GOST standards for color, clarity, and overall quality.

3.Effective varroatosis management is essential to preserve honey quality, marketability, and consumer health.

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