Organoleptic and laboratory analysis of flavoured acacia honeys

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Abstract: Our goal was to examine the organoleptic and laboratory (pH value, oxidation-reduction potential, electrical conductivity, total dissolved solids, salt, colour and viscosity) characteristics of acacia honey-based flavoured honeys. The purpose of the tasting was to assess consumer perceptions and rankings of five different varieties of acacia honey—lavender, sour cherry, elderberry, water mint, and lemon balm. The overall impression showed that the lemon balm and lavender honeys were the most favourable flavoured honeys. The black elder and sour cherry honeys ranked in the middle of the scale, while the water mint honey received the lowest overall rating, mainly due to its unique, divisive flavour. The water content remained below 18.5% in all flavoured honeys. Electrical conductivity, pH, and salt content also fall within the usual, safe ranges, meaning that the added plant-based ingredients did not impair quality parameters. Our results confirmed that, with good technology, continuous monitoring, and careful selection of raw materials, flavoured honeys are not only safe but also offer a new, consumer-friendly experience on the market.

Keywords: acacia honey, flavoured honey, consumer preference

Introduction

There have been major innovations and changes in strategy in the flavoured honey market in recent years, with the goal of increasing the competitiveness of domestic beekeepers as well as broadening the product line. These innovations are becoming more in line with the demand for premium-quality, natural, and health-conscious products among consumers (Vida and Feketéné Ferenczi, 2023). These are varieties enriched with various herbs, fruits, or spices, which add variety to the flavour profile and can also enhance the functional value of the honey, as the added plant-based components can provide additional bioactive compounds, antioxidants, and unique health-promoting benefits (Viuda-Martos et al., 2008). Certain herbs, such as lavender or thyme, have been shown to have anti-inflammatory, or immune-boosting properties, while fruits like sour cherries or elderberries help support the immune system due to their high antioxidant content (Schmitzer et al., 2010).

The unique characteristics of acacia honey—its light colour, mild, balanced flavour, high fructose content, and slow crystallization—make it an ideal base for producing flavoured honeys (Oravecz and Kovács, 2019).

Plant-based ingredients—such as lavender, lemon balm, elderberry, sour cherry, and water mint—are most often added to honey in dried form so as not to increase the final product's water content or compromise its shelf life (Predanócyová and Šedík, 2024). During the ripening process, the honey absorbs the aroma, colour and bioactive compounds of the plants, offering a more complex health and culinary experience (Chua et al., 2013).

The physical properties of flavoured honeys depend on both the base honey and the plant-based flavourings. Honeys generally vary in water content, which is reflected in their viscosity and density. Honey density ranges between 1.39 and 1.47 g/cm^3 depending on a 20% moisture content, which affects its fluidity and tendency to crystallize (Bogdanov, 2017).

The chemical composition consists largely of glucose and fructose, as well as sucrose, maltose, and other components (Cianciosi et al., 2018). Plant-derived substances in the additives, such as flavonoids and polyphenols, have an impact on the antioxidant capacity and biological activity (Dias et al., 2021).

Among the sensory characteristics, the complexity of aromas stands out in flavoured honeys, which derive from the natural aromas of the herbs or fruits used. It is important that the flavours and aromas harmoniously complement the character of the base honey, which thus offers a smooth yet distinctive, unique experience. The texture of the honey is a liquid or slightly thickened form developed during filtration and maturation, which preserves the richness of the aromas while remaining stable and easy to store (DLG Expert Report, 2016).

Premium-quality flavoured honeys are released as seasonal or limited-edition products, serving not only as a culinary delight but also as a special gift (Predanócyová and Šedík, 2024). There is a growing demand among consumers for healthy yet exciting, natural products, making flavoured honeys ideal for followers of modern dietary trends such as slow food and clean eating (Vida and Feketéné Ferenczi, 2023).

The wide range of usage possibilities requires thorough quality control and continuous monitoring of consumer preferences to ensure that high-quality products meeting market demands are brought to market, offering both a gastronomic experience and health benefits (Šedík et al., 2023).

For this reason, our goal was to examine the organoleptic and laboratory characteristics of acacia honey-based flavoured honeys. The purpose of the tasting was to assess consumer perceptions, rankings, and sensory characteristics of five different varieties of acacia honey—lavender, sour cherry, elderberry, water mint, and lemon balm.

Materials and methods

Samples

The same honey samples were used for the laboratory and organoleptic tests. The samples were sourced from the Mr. Méz apiary (Sajókaza, Hungary). The control sample was natural, unflavoured Hungarian acacia honey. Lavender (*Lavandula angustifolia*) flowers, sour cherry (*Prunus cerasus*) fruit, black elder (*Sambucus nigra* L.) flowers, water mint (*Mentha aquatica*) leaves, and lemon balm (*Melissa officinalis*) leaves were soaked for two months to flavour the acacia honey, which was then filtered and packaged.

Organoleptic test

Thirty people participated in the sensory honey tasting. Each sample was tasted individually in a blind test (numbered and unlabelled), and then evaluated using a pre-prepared evaluation form. The list of flavours had been provided to participants in advance, so they knew which flavours would be included in the tasting, but the order was unknown to them. This method helped eliminate any preconceptions that might have been based on prior expectations, while ensuring that everyone could evaluate each flavour.

Participants were required to evaluate each sample based on the following organoleptic parameters:

- Colour (on a scale of 1–5)
- Aroma (on a scale of 1–4, specifying the type of aroma: e.g., fruity, floral, spicy, sweet, other)
- Texture (on a scale of 1 to 5)
- First impression/Flavour (on a scale of 1–5, specifying the dominant flavour note)
- Aftertaste (on a scale of 1–5, with a comment)
- Serving suggestion (e.g., in tea, on toast, in desserts, with drinks, in salads, with meats)
- Overall impression (on a scale of 1–10)
- Brief opinion (optional).

During the tasting, each participant used a separate small spoon and was allowed to drink water between samples to neutralize their taste buds. The evaluation forms were filled out anonymously, with a separate line for each sample. The tasting took place in a calm environment free of distracting odours.

Laboratory test

Laboratory tests were conducted at the Animal Product Testing, Teaching, and Research Laboratory of the Department of Animal Production Technology and Animal Welfare at the Institute of Animal Science. The pH value, ORP (oxidation-reduction potential, mV), electrical conductivity (mS/cm), TDS (Total Dissolved Solids, ppm) and salt (NaCl, ppm) were measured by VOLTCRAFT KBM-700 equipment (Conrad Electronic SE, Hirschau,

Germany). Minolta Chromameter CR-400 (Konica Minolta, Tokyo, Japan) was used to determined colour parameters (L* lightness, a* redness, b* yellowness).

Viscosity was analysed using the Stable Micro Systems (Godalming, United Kingdom) TA.XT Plus C texture analyser with the backward extrusion Rig accessory, which features a special sample holder and a disc-shaped piston to determine the consistency of viscous liquids (Figure 1.)

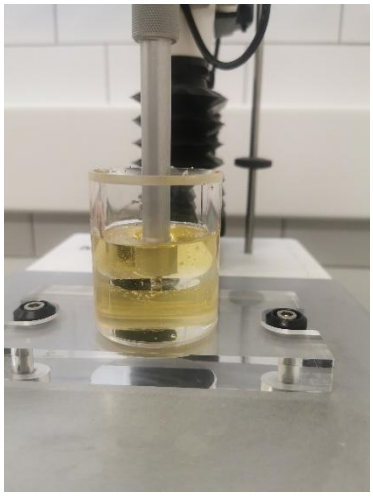

Figure 1 Viscosity measurement

For statistical analysis, the R 3.4.2 program was used. Following a normality test (Shapiro–Wilk test), one-way analysis of variance (ANOVA) was performed with a Tukey post-hoc test at a significance level of $p \leq 0.05$.

Results

Organoleptic test

The highest average colour score was achieved by the cherry (4.5) and lavender (4.4) honeys, which stood out with their intense, distinctive hues. The lemongrass (4.1) and elderflower (4) honeys had a lighter colour, while the water mint sample, with its greenish tone, was unique but less popular in this aspect (3.8). In the case of aroma, the lemongrass and lavender honeys received the most positive ratings (natural, pleasant, intensive), thanks to their aromatic and easily recognizable scents. The cherry honey was intensely fruity (3.7), the elderflower honey was floral but not enough intensive (3.4), while the water mint sample had a minty, refreshing, yet divisive scent (3.1).

The texture of lavender (4.8) and lemongrass (4.8) honeys had the most balanced, smooth, and spreadable texture. Participants sometimes noted a slightly grainy texture in the elderflower and cherry flavoured honey samples, while the water mint honey was judged to be slightly thicker. In terms of first impressions, the lemongrass and lavender honeys stood out for their harmonious, refreshing flavours (4.9). The elderflower and sour cherry varieties had distinctive, fruity flavours, but were less balanced (4.7). The water mint honey's minty, unique flavour divided the tasters—some found it refreshing, while others found it too intense (4). In the evaluation of the aftertaste, the lemongrass and lavender honeys also received the highest scores (4.8); participants highlighted their harmonious, slightly herbal finish. The elderflower and sour cherry flavoured honeys were a fruity aftertaste dominated (4.6), while the water mint flavour was characterized by a

minty, cooling aftertaste, which also divided consumers (4.1). Based on the overall impression, the lemon balm and lavender honeys received the highest average scores. The elderflower and sour cherry honeys ranked in the middle of the scale, while the water mint honey received the lowest overall rating, mainly due to its distinctive, divisive flavour profile (Table 1.).

Participants recommended the lemongrass and lavender honeys primarily for tea, breakfast, and desserts. The elderflower and sour cherry varieties were recommended mostly for desserts, yogurt, and pastries, while the water mint honey was suggested for beverages, lemonade, and salads.

Table 1 Ranking of honey samples based on overall impression

Rank	Sample	Overall impression
1.	Lavender	7.1
2.	lemon balm	7.0
3.	sour cherry	6.7
4.	black elder	6.0
5.	water mint	5.3

Laboratory test

The pH value remained within the safe acidic range (3.8–4.5) for all samples tested; the lowest value was observed in the sour cherry honey. The sample with the highest ORP, which is also valuable from an antioxidant perspective, was the sour cherry variety. The increase in electrical conductivity was particularly significant in the case of fruit-based (sour cherry, elderberry) honeys. The salt and TDS values remained below the limits specified in the Hungarian Food Code in all cases (Table 2.).

In the case of the L* value, the black elder and lemon balm flavoured honey samples did not differ from the control (acacia) honey, while the lightness of the sour cherry and water mint were significantly different compare to each sample ($p < 0.001$). The a* values of the control and lemon balm samples are significantly distinct from the sour cherry, elderberry, and water mint samples ($p < 0.0001$). The b* parameter of all tested honey samples differ significantly from the control and from each other ($p < 0.001$) (Table 3.).

In the case of viscosity, the black elder flavoured honey sample (34.8 g) differed significantly from the control and other samples. There was no significant difference between the control and sour cherry samples (104.6 g vs. 108.4 g), nor between the water mint (86.6 g) and lemon balm (80.1 g) samples.

Table 2 Laboratory test results

Parameters	Control acacia	Lavender	Sour cherry	Black elder	Water mint	Lemon balm
pH	4.48	4.42	3.82	4.53	4.53	4.48
ORP	151.40	153.50	194.80	152.10	151.30	155.80
electrical conductivity	0.00	0.10	2.00	2.10	1.20	1.10
TDS	0.00	0.00	1.10	1.30	0.60	0.60
Salt	0.00	0.00	0.50	0.60	0.30	0.30

Table 3 Colour results of honey samples

Sample	L*	a*	b*
Control	45,24a	–1,78a	7,95a
Sour cherry	37,90b	2,35b	19,11b
Black elder	44,02a	–2,49c	15,41c
Water mint	35,07c	4,52d	20,80d
Lemon balm	42,90a	–1,68a	13,55e

Conclusions

Harmonious, natural flavours, a pleasant aroma, and a good texture were rated most positively, while overly intense or unusual flavours (e.g., water mint) tended to be more dividing. The results of the sensory evaluation are closely consistent with the data from our previous questionnaire surveys (Janda and Szabó, 2025): lemon balm and lavender flavours proved to be the most popular in every respect, while the elderberry, sour cherry, and especially the water mint varieties tend to meet more specific, niche demands.

Based on organoleptic test, the popularity and acceptance of flavoured acacia honeys are exceptionally high, particularly for the lemongrass and lavender varieties. The majority of respondents consume these honeys regularly, primarily with tea, for breakfast, in desserts, and as gifts. Black elder and cherry flavours rank in the middle of the list, while water mint honey is considered more of a niche product, recommended mainly for beverages. Consumer decisions are most influenced by natural ingredients, the absence of additives, health benefits, and a harmonious, not overly intense flavour profile, and most people purchase these products directly from producers or at markets. In the work of Predanócyová and Šedík, 2024, the fruity flavour (raspberry) was the second after cinnamon flavour in aroma, taste and overall acceptance parameters, but it was the most preferred in colour parameter.

All flavoured honeys were safe to consume: the water content remained below 18.5% in all cases, so there is no microbiological risk. The fruit content is entirely natural and do not compromise the quality of the final product. Electrical conductivity, pH, and salt content also fall within the usual, safe ranges, meaning that the added plant-based ingredients did not impair stability or freshness, enzyme activity was preserved (Codex Alimentarius Hungaricus, 2002, 2003). Based on our results and highlights of Thamkaew et al.

(2021), it is recommended to use only dried herbs or fruits with low water content for each production batch; processing should be carried out at a maximum temperature of 40°C to prevent damage to enzymes and bioactive compounds. To ensure flavour transfer, a maturation period of at least 1–2 weeks is recommended, and laboratory testing of each batch is required. It is advisable to choose sustainable raw materials and eco-friendly packaging. Our results confirmed that, with good technology, continuous monitoring, and careful selection of raw materials, flavoured honeys are not only safe but also offer a new, consumer-friendly experience on the market.

Based on the results, it is suggested to focus on the most popular flavours (lemon balm, lavender) during market launch and marketing communications, as these performed exceptionally well across all organoleptic parameters. Due to their characteristic, fruity aromas, elderflower and sour cherry honeys are primarily recommended by consumers for desserts, yogurt, and pastries; therefore, it is advisable to emphasize these usage suggestions on the packaging and in marketing materials. Because of its unique, minty flavour, water mint honey could be successful as a limited-edition, sample-sized product or when recommended for beverages, as it is popular among innovative consumers seeking something special.

Consumer education, emphasizing quality and naturalness, developing innovative flavours, and developing targeted marketing and digital channels are essential for a successful market position. The development and promotion of flavoured acacia honeys can open up new avenues for Hungarian beekeeping, particularly among young, health-conscious consumers. Predanócyová and Šedík, 2024 pointed out that honey, especially among the young generation, is not an attractive food for consumption in Slovakia. The results confirm that these products are not only high-quality and safe but also represent an innovative, marketable alternative to traditional honeys and could attract the attention of all generations.

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