Buckwheat honey: screening of composition and general properties

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Introduction

Because of the quite low cultivation of buckwheat plants (\textit{Fagopyrum esculentum}), in Italy monofloral buckwheat honey is uncommon and it is usually found as a part of multifloral honeys. Due to increased focus on healthy foods, there is a growing interest in the production of foods made from buckwheat. More extensive cultivation of this plant have been projected for the future and the amount of monofloral honey available on the market may consequently increase.

The botanical and geographical origin of honey has been traditionally identified by the analysis of the bee pollen present in the honey, together with organoleptic and physicochemical determinations. However, in order to improve the monofloral assessment of buckwheat honey these information should be enriched with data derived from the aromatic profile and bioactive components. Therefore, new analytical methods have also been developed and among them, the determination of specific markers, such as phenolic compounds, is one of the most promising way for studying the healthy properties and quality of honeys.

The principal aim of this study was to propose a preliminary but comprehensive and detailed investigation of the composition and properties of that botanical origin.

Materials and methods

Ten buckwheat honeys samples were bought from Italian and eastern European beekeepers and evaluated by means of their pollen, physico-chemical, sensory, phenolic and volatile composition data. They were characterised on the basis of the following analyses:

- **pollen analysis** according to the Italian standard UNI 11299:2008 method;
- **physicochemical parameters** (electrical conductivity, colour, pH and acidities, diastase activity, specific rotation, hydroxymethylfurfural (HMF) and sugars), according to the standardized methods proposed by the International Honey Commission (2009);
- **phenolic compounds** by High Performance Liquid Chromatography with Diode Array UV-VIS and Mass Spectrometer Detectors (HPLC-DAD-MSD);
- **volatile compounds** using the Solid Phase Microextraction (SPME) and a Gas Chromatography with Flam Ionization and Mass Spectrometer Detectors (GC-FID-MSD).

Results

With respect to the **physicochemical analysis**, in Table 1 are reported the parameters with higher discrimination, suggesting the presence of three blended honeys. In particular, the values of samples B-1, B-9 and B-10 (1.02, 1.37 and 1.86 mS/cm, respectively) exceeded the limit allowed for floral honeys (0.8 mS/cm), suggesting the likely presence of honeydew. For the optical rotation of polarized light the same samples were found to be dextrorotatory like honeydew and in contrast to floral honey, which are levorotatory. Also pH value of the same three honeys showed typical honeydew value that ranged from 4.5 to 5.5. Sugar composition also supports these results: the suspected blended samples had a lower monosaccharides (glucose and fructose) content and relative higher content in disaccharides and polysaccharides.

The frequency of the \textit{Fagopyrum esculentum} was not so high. Sample B-1 showed the lowest value, whereas B-8, B-9 and B-10 the highest ones. Considering the previous results, the frequency values of B-9 and B-10 highlighted the presence of honeydew, because honeydew is a sugar without pollen, thus the pollen % of other varieties increase

![Phenolic compounds](image1)

Figure 1 – Phenolic compounds

More than 100 **volatile compounds** were positively identified and most of them were present in all honey samples even if in different amount. The content of some volatile compounds corroborate the physicochemical results. Some typical aroma compounds of buckwheat honey such as 3-methylbutanoic acid, \(p\)-cresol and the 2- and 3-methylbutanal (important aromas compound that contribute to the overall malty flavour of buckwheat honey) were present in high amount in B-8, whereas they were absent or in low % in the three suspected blended samples (B-1, B-9 and B-10). Besides in these three samples was not found the 3,5-dimethoxybenzaldehyde, an other compound suggested to be present in buckwheat honey, but they reported the highest amount of acetic acid suggested as being indicative of honeydew.

![Phenolic profile](image2)

The **phenolic profile** of the 10 buckwheat honeys did not suggest further information on the samples. The HPLC-UV chromatograms, recorded at 280 and 330 nm for phenolic acids and flavonoids respectively, indicated that most of the honeys tested had similar but quantitatively different phenolic profiles. As shown in Figure 1, up to 20 peaks could be assigned to phenolic compounds and identified as phenolic acids (peaks 1-10), abscisic acids (peaks 11 and 12) and flavonoids (peaks 13-20). As the phenolic compounds did not show important differences across the samples, due to the difficulty of collecting species-specific buckwheat honeys for the analysis, further studies are necessary to analyze more samples of the selected honeys. However, the high amount of \(p\)-coumaric and \(p\)-hydroxybenzoic acid could be consider as a characteristic of this kind of honey, as already reported by other authors.

Conclusion

The analytical results obtained for our honeys reveal the presence of three poorly pure samples (B-1, B-9 and B-10) which despite of their label cannot be useful for the characterisation of the buckwheat, presenting a strong blend with honeydew honey or nectar from different origin. The volatile analysis of the remaining samples showed more than 100 volatile compounds with the 3-methylbutanoic acid as principal one. This molecule in combination with 2- and 3-methylbutanal and phenyacetaldehyde contribute to the typical buckwheat aroma of our samples. In the same honey samples, the phenolic profile was similar and showed \(p\)-hydroxybenzoic and \(p\)-coumaric acids as the main components. On these bases, the phenolic pattern and a significant content of 3-methylbutanoic acid in the aromatic profile could be treated as possible fingerprints of buckwheat honey, in the course of a preliminary estimation of the quality of this unifloral honey.

In conclusion, our approach, using all the parameters previously mentioned, provide an entrance to further research with a larger number of samples in order to improve the interest and knowledge about this honey and its quality profiles.