Honey Analyses

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The study of pollen in honey, known as melissopalynology, is widely used to determine honey samples' geographic and botanical origins. It is based on the study and determination of the pollen grains that are contained in the honey. This is an astonishing and peculiar characteristic of this product because it carries inside elements of its origin, like a fingerprint or an identity card.

Furthermore, pollen analysis may provide some critical information about honey processes like extraction and filtration, fermentation and some kinds of adulteration.

Melissopalynological analysis is very complicated and requires specific and in-depth training. My intent here is to give you just some information to better understand the importance and use of this technique. If you are interested in this topic and want to go deeper into it, you can find a lot of information on the internet.

To perform honey pollen analysis, melissopalynologists extract the pollen grains from honey by centrifuging a honey solution (Figure 1, Figure 2). Pollen grains are put on a slide and studied under the microscope. The analyst examines the shape, size, surface decoration and other morphological characteristics to identify individual pollen grains, very small in size, usually 10–200 µm. Eventually, from the level of abundance and relative frequency of the pollen types, it is possible to determine the botanical and geographical origin of the sample.

As this analysis is based on pollen grain recognition and count, it applies only to samples that have not been filtered in a way that pollen has been removed.

Botanical Origin

It is well known that honey contains pollen that derives from the flowers the bees visited to collect nectar. Experts refer to this 'contamination' by pollen as enrichment. The wind, the bees visiting the flowers and other factors are the cause of honey enrichment. Pollen grains fall from the anthers of the flower into the nectar. The abundance of pollen grains in nectar is typical and very variable for different plant species.

Usually, there is no direct relationship between the collected nectar and the percentage of pollen found in honey. So, we have nectar in which pollen is over-represented (nectar that contains a vast amount of pollen grains), represented normally, or under-represented (nectar that contains only a few pollen grains or none at all).

For example, one gramme of nectar from *Robinia* contains only 100, or just a little more, pollen grains, whereas one gramme of nectar from *Myosotis* may contain more than 14,000,000 pollen grains. Therefore, it is easy to understand that if we have a perfect 50:50 blend of the two nectars mentioned, the proportions of pollen do not correspond to the proportions of nectar. This means that the general statement that honey is considered to come predominantly from a given botanical origin (unifloral honey) when the pollen content of a specific species exceeds 45 per cent is not always true. The melissopalynologist should be aware of the many plant species' differences and know the pollen's typical relative frequency for each plant.

Specific Limits

For the characterisation and evaluation of unifloral honey in Italy, we have established specific limits below which the pollen content must not fall to classify honey as unifloral. For instance, acacia honey is considered unifloral if the pollen grains from acacia are >15 per cent (of the total amount of pollen from nectariferous species). For citrus, the amount is >10 per cent (under-represented pollen). Still, for chestnut and eucalyptus it must be >90 per cent (over-represented pollen).

Because of the numerous over- or under-represented pollen types for correct interpretation of botanical origin, it is strongly recommended that other characteristics of the honey should be taken into consideration, such as sensory and physicochemical data. It is important the beekeeper does not interpret the results of analyses without relying on expert declarations or specifications.

Geographical Origin

Honey does not contain only the pollen grains of the species which the bees collected the nectar from, but also pollen from other plants that gets into the honey in different ways. Bees collect pollen to satisfy their protein requirements from many plants, either nectariferous or not. Once inside the hive, this pollen can contaminate the nectar (secondary enrichment). Tertiary enrichment occurs during the extraction of honey from the comb (eg, from combs containing pollen). Quaternary

Figure 1. Honey solution inside a test tube before centrifuging

Figure 2. After centrifuging, the liquid is removed. The sediment contains the pollen

enrichment derives from airborne pollen produced by wind-pollinated plants that float in the air. Many types of pollen end up in honey eventually, which can be the source of many problems when evaluating botanical origin. To the contrary, when assessing geographical origin, these contaminations give the analyst useful information regarding the flora of the gathering area.

The pollen spectrum, derived from honey's sediment, is consistent with the flora of a particular country, region, or area. It reflects the floral situation of the place where that particular honey was produced and, therefore, it is possible to determine where the honey was collected.

Sensory Analysis

Sensory analysis is the evaluation of a product through our senses. It is important to underline the difference between sensory analysis and just tasting a product. Sensory analysis is a science – an actual analytical method. It has been defined by the ISO, the International Standards Organisation, that publishes the standard analytical methods accepted worldwide. It defines sensory analysis as the science involved with the assessment of the organoleptic attributes of a product by the senses.

We use our senses to get information about a product with the aim of measuring the quality and the intensity of what we perceive. In other words, sensory analysis is used to measure how much a food is liked, who likes it and why, verify differences between products and study the product's organoleptic profile. It is not a simple tasting that you do, for example, to find out if you like it or not, or taste something new. In sensory analysis assessment, there are many conditioning factors and variables that can affect the results. For this reason, it is necessary to select and train assessors and to use a group of assessors (panel). The procedure must be rigorous and statistical evaluation has to be adopted. The purpose of the sensory analysis is, first of all, to bring complementary information to traditional analyses. The chemical analysis gives information on the global composition of a product, on its nutritional and possible dietetic value. Still, all of this is insufficient to entirely and objectively define a food.

We have astonishing physicochemical methods that tell us about the composition and physical characteristics of all foods, but they can't reveal consumers' reactions, for example.

Furthermore, our senses do not work like analytical machines. We do not reveal a single component, but sensation results from many complexities. Chemical composition is not sufficient to know the sensory property of a product and how we perceive it. Do we like it? Is it bitter or sweet enough? Too many complexities exist to predict human sensory perceptions.

Sensory analysis is used for many purposes, eg, official controls, scientific research, to test the product's quality and consumer preferences. But it is also beneficial for the beekeeper because it provides him/her with valuable information in order to correctly name the product and for offering the consumer the highest quality.

It must be considered that consumers, besides a product of high quality, want to enjoy the sensory properties of the honey which reflect its botanical origin, or those characteristics typical of the honey that comes from a specific area or region. Therefore, botanical source, production region and level of purity of honey are of greater importance.

In the field of apiculture, it is an essential tool (required by the European Uinion [EU] regulation) to distinguish the honey's botanical origin and to identify some defects like fermentation, impurities, and off-odours or aroma.

We can use different sensory analysis methods depending on the results we want to obtain or the aim of the analysis. In general, we can use it for scientific and control purposes, technical purposes, trade, and enjoyment of the product.

Honey Evaluation

In honey evaluation, we use sensory analysis mainly for two reasons, equally important:

1. As an objective analytical tool
    a. to study, evaluate and control the botanical origin
    b. to assess quality (eg, fermentation, odour of smoke, metallic taste)
2. As a means to promote and add value.

Each honey is characterised by specific colour. This is obvious, but if you smell and taste it carefully, it is possible to perceive distinctive organoleptic characteristics that make each honey unique. To name a honey as unifloral, we must study the sensory characteristics besides the physicochemical and microscopic properties. For the sensory characterisation of a honey type, a group of trained experts must explore the sensory profile and describe the organoleptic perceptions of a large number of samples. To have a complete and realistic sensory picture of the honey type, the samples must have been collected over several years and come from different areas. At the end we can complete the unifloral honey card with sensory information, together with the physicochemical and pollen characteristics.

Product Presentation

Beekeepers may use sensory analysis to aid better presentation of the honey. In fact, beekeepers that become expert in honey sensory analysis learn to give importance to all those aspects that are important to consumers. They become aware of the importance of presenting a perfect product. Honey must be clean and without any kind of defects, like fermentation, off-odour and aroma; they learn how to prevent them. They can verify the botanical origin and use the correct descriptor in labelling. This step is crucial in Italy because almost 50 per cent of the honeys are sold as monofloral.

Furthermore, beekeepers can promote the product in schools, at markets, at trade fairs, etc, by 'getting to know' the product and its endless varieties of smells and flavours. They can offer a wide range of products and they must understand the preferences of their clients and offer them the most suitable product. If a beekeeper has a broad knowledge of the honey, he can offer a better product and educate the consumer about it.

Last, but not least, sensory analysis is used in honey competitions. This is one of the most powerful means that can be used to promote and add value to the product. With minimal costs, a lot of promotion can be done, which is the key to successful sales. For this reason, over time, honey competitions, regionally as well as nationally, have flourished all over Italy.

For all these activities, expert assessors have to be trained on specific courses. You cannot become a sensory analyst overnight. It requires specific competence, capabilities and knowledge. Furthermore it requires physical and mental aptitudes, such as sensitivity, concentration and good health.

Further Information

In Italy, there is a long tradition in this field and the first course in sensory analysis was held in 1979. For more information regarding sensory analysis courses, see: www.beesources.com/en/honey-tasting-course-3/ □