

Physical and Chemical Properties of Nepalese Honey

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There is a long tradition of beekeeping and harvesting honey in Nepal where several species of honeybee are found. Honey is harvested and marketed mainly from *Apis cerana*, *A. dorsata*, *A. laboriosa* and *A. mellifera*. It can be divided into two broad types in terms of the method of harvesting: squeezed and extracted. *A. dorsata* and *A. laboriosa* are wild honeybee species. They only produce squeezed honey. *A. cerana* is managed in log hives in many parts of the country although it is also kept in modern movable-frame hives; so, honey from *A. cerana* can be either squeezed or extracted. *A. mellifera* is popular only with commercial beekeepers and its honey is entirely extracted. Although *A. florea* bees do live in Nepal, their honey is not available in the market.

Since honey is produced by different bee species during different seasons with different floral compositions, and harvesting techniques and post-harvesting handling differ, the quality of honey varies accordingly. However, honey produced on-farm is always of good quality with special floral composition.

Beekeeping Development and Environment Conservation Organization (BEEDECO) is an NGO involved in strengthening beekeeping in Nepal. Among its activities the organization carries out honey-quality testing and laboratory

analysis for rural farmers. The organization also carries out research on Nepalese honey quality with support from the International Foundation of Science, Sweden and the Netherlands Development Organization, Nepal.

Methodology

Four hundred honey samples were analyzed in the laboratory using a simple low-tech method. Samples were collected from bee species as follows.

<i>Apis cerana</i> (beekeepers)	300
<i>Apis cerana</i> (directly from hive)	60
<i>Apis mellifera</i>	30
<i>Apis dorsata</i>	10
Total	400

Analyses were as follows.

- Moisture content: by hand refractometer (EU/ Apimondia Honey Commission, 1995).
- Reducing sugar and apparent sucrose: titration method Codex Alimentarius Commission, 1989.
- HMF (Hydroxymethyl Furfural) extraction with ethylacetate and colour measurement with resorcinol (White *et al.*, 1988).
- Peroxide accumulation (glucose oxidase): screening with peroxide test strips (Kerkvliet, 1994).

- pH and electrical conductivity: measurement in 20% (m/m) solution (Kerkvliet, 1992).
- Diastase: Codex Alimentarius Commission (1989).
- Products (Kerkvliet *et al.*, 1995); (b) pollen analysis (Louveaux *et al.*, 1978).

Results

Moisture content

Moisture content was in the range 13.4–27.5% (Table 1). The lowest moisture content recorded was from *A. cerana* honey collected directly from modern hives. The moisture content of *A. dorsata* honey was highest with an average of 23.2%.

Table 1: Physico-chemical properties of Nepalese honey

Parameter	Source	Average	Range
Moisture content (%)	<i>A. cerana</i>	19.44 ± 2.33	13.40 – 26.00
	<i>A. mellifera</i>	18.75 ± 1.03	17.00 – 20.00
	<i>A. dorsata</i>	23.20 ± 2.44	19.70 – 27.50
Reducing sugar (%)	<i>A. cerana</i>	68.21 ± 4.57	58.10 – 80.30
	<i>A. mellifera</i>	74.93 ± 3.74	64.42 – 74.93
	<i>A. dorsata</i>	65.69 ± 3.30	61.33 – 71.23
Sucrose (%)	<i>A. cerana</i>	4.00 ± 2.51	0.69 – 13.00
	<i>A. mellifera</i>	2.00 ± 1.80	0.55 – 8.39
	<i>A. dorsata</i>	2.23 ± 1.20	0.69 – 4.64
HMF (mg/kg)	<i>A. cerana</i> , <i>A. mellifera</i> and <i>A. dorsata</i>	<10	<10 – 40
Peroxide accumulation (µg/g/hr at 20°C)	<i>A. cerana</i>	10	0 – 25
	<i>A. mellifera</i>	25	10 – 50
	<i>A. dorsata</i>	10	0 – 25
pH	<i>A. cerana</i>	4.5	3.35 – 5.85
	<i>A. mellifera</i>	4.11	3.65 – 4.39
	<i>A. dorsata</i>	4.72	4.20 – 5.25
Electrical conductivity m/cm	<i>A. cerana</i>	701.11	200 – 1010
	<i>A. mellifera</i>	303.00	130 – 690
	<i>A. dorsata</i>	1062.50	930 – 1190
Diastase (number)	<i>A. cerana</i>		≤ 5 – 22
	<i>A. mellifera</i>		7 – 26
	<i>A. dorsata</i>		≤ 5 – 8

A. mellifera honey had the lowest average of 18.75%.

Reducing sugar

Reducing sugar content was in the range 58.1–80.3% (Table 1). The highest and lowest reducing sugar content was found in *A. cerana* honey. Only 5.3% of the *A. mellifera* samples contained less than 65% reducing sugar, where as 25% of the *A. cerana* samples and 50% of the *A. dorsata* samples did. This indicates that *A. cerana* honey and *A. dorsata* honey contain less reducing sugar than *A. mellifera* honey.

Sucrose

The maximum and minimum sucrose contents recorded were 0.55% and 13.0% (Table 1). Although one sample of *A. cerana* honey collected directly from the hive contained 13% sucrose, most samples contained less than 5% sucrose. One sample of *A. mellifera* honey contained 8.39% sucrose and the rest were lower than 5%. All samples of *A. dorsata* honey contained less than 5%.

HMF

The semi-quantitative method used to analyse HMF content of 221 honey samples gave the following results.

HMF content (mg/kg)	No. of samples
Less than 10	158
Between 10–20	49
Between 20–30	12
Between 30–40	2

The HMF content of all honey samples tested was less than 40 mg/kg (Table 1). Only heated and adulterated honey contains more than 40 mg/kg of HMF.

Peroxide accumulation

Peroxide accumulation was highest in *A. mellifera* samples. It ranged from 2.5 to 50 µg/g/hr at 20°C in *A. mellifera* honey and 0 to 25 µg/g/hr at 20°C in *A. cerana* and *A. dorsata* honey (Table 1).

Peroxide accumulation ($\mu\text{g/g/hr}$ at 20°C)	<i>A. cerana</i> (% of sample)	<i>A. mellifera</i> (% of sample)	<i>A. dorsata</i> (% of sample)
0.0	6	0	20
2.5	35	6	10
10.0	49	21	50
25.0	10	45	20
50.0	0	28	0

Relationship between HMF and peroxide accumulation showed that where peroxide accumulation was greater than $10 \mu\text{g/g/hr}$ at 20°C , then HMF was below 20 mg/kg .

pH and electrical conductivity

The pH of *A. cerana* honey showed the greatest range from 3.35 to 5.85, and the average (4.11) was lowest for *A. mellifera* (Table 1). Electrical conductivity of *A. cerana* also showed the greatest range from 200 to 1010 and the average (303) was again lowest for *A. mellifera* honey.

Diastase

Diastase values for *A. cerana* and *A. dorsata* were lower than those of *A. mellifera* (Table 1).

Conclusion

- Honey-quality analysis to assess adulteration and authenticity can be carried out using simple low-tech and cheap methods.

- Quality analyses of Nepalese honey indicated that in general there is good compliance with codex regulation. Each type of honey has its own characteristics. *A. mellifera* honey showed the most desirable characters while *A. dorsata* showed the least desirable ones.
- Further study on botanical origin of the honey is necessary to find out the reasons for differing values of parameters.

References

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