

PHYSICO-CHEMICAL ANALYSIS OF HONEY OF *APIS CERANA INDICA* AND *APIS MELLIFERA* FROM DIFFERENT REGIONS OF ANANTNAG DISTRICT, JAMMU & KASHMIR

MUDASAR MANZOOR*, V.MATHIVANAN, GH. NABI SHAH, G. M. MIR** AND SELVISABHANAYAKAM

Department of Zoology, Annamalai University, Annamalai Nagar 608 002, Tamil Nadu, India, **Division of Entomology, Sher-e-Kashmir University of Agricultural Science and technology Kashmir 191121. Email: mudasarzooology@gmail.com

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ABSTRACT

Objective: The aim of the present study was to analyse Physico-chemical properties of honey samples collected from different regions of District Anantnag J&K by using different analyses tests, viz Moisture content, Viscosity, Refractive Index, surface tension, Ash content, Density and pH.

Methods: Various Techniques were used to analyse the honey samples. Abb's Refractometer was used to determine refractive index, optical density was calculated by Calorimeter, Moisture content by Refractometry, viscosity by Ostwald's viscometer, surface tension by capillary drop weight, Density by Density bottle and pH by Hanan pH meter.

Results: Physico-chemical studies revealed that moisture content, Ash content, pH and Density of *Apis cerana* were slightly higher than *Apis mellifera*, while as viscosity, surface tension, optical density and refractive index of *Apis mellifera* were found to be 3.017, 1.03, 1.061 and 2.235 respectively and were higher than *Apis cerana*. Moisture content, surface tension, Ash content and pH of these honey samples differ significantly.

Conclusion: This study revealed the identification of Physico-Chemical properties of Jammu & Kashmir honey.

Keywords: *Apis cerana indica*, *Apis mellifera*, Physico-chemical analysis, J & K.

INTRODUCTION

Honey is produced by honeybees from nectars extracted from nectarines of flower [1] or from the secretion of living parts of plants or from excretion of plant sucking insects when live on plants [2]. Freshly collected honey is viscous liquid, has a greater density than water, a strong hygroscopic character, relatively low heat conductivity, a low surface tension and various colors that are basically all nuances of yellow amber [3-5].

Honeybees are bio indicators of environment and eusocial hymenopterans which are reliant on floral wealth like nectar and pollen. The amount of honey produced from the nectarines depends on the total quantity of nectar secreted and the sugar concentration of the nectar [6]. Since times immemorial; honey and milk are considered as symbol of prosperity and sanctity. Honey besides milk, curd, sugar and ghee are essential ingredients of panchamrutha, food offerings to God and religious ceremonies.

Honey was found to be a suitable alternative for healing wounds, burns and various skin conditions and also to have a potential role in cancer care. The intrinsic properties of honey have been reported to affect the growth and survival of microorganisms by bacteriostatic or bactericidal actions [7].

The change in the composition and properties of honey depends on the floral and honey dew sources collected by honey bees, as well as on regional and climatic conditions [8-9]. Therefore, the present study was aimed to investigate some properties of various samples collected from different regions in Kashmir by using different honey analysis tests viz, moisture, viscosity, refractive index, surface tension and optical density. These determinations are highly useful for determining the quality of honey, which is needed for medicinal treatment and international trade.

MATERIALS AND METHODS

The Anantnag district extends in south and south western direction of J & K. Geographically this district lies between 330-20' to 340-351' east longitude and location of Anantnag at an elevation of 5,300 feet (1,600m) above the sea level. The temperature of the district lies between 5 °C-36 °C with maximum rainfall.

Sample Collection

Honey samples were collected from different regions in Kashmir and were stored at 0 °C until analysis, which occurred no longer than one month after extraction from the hives by beekeepers.

Moisture content

Moisture content was determined by refractometry, using an Atago (Japan) model IT Abbe refractometer. All measurements were performed at 25 °C.

Determination of refractive index of honey

Refractive index of honey was measured with the help of Abbe's refractometer Model no. R-8 29016 [10].

Detection of optical density of honey

Optical density of honey was determined by colorimeter Model no. ELC-157 [10].

Measurement of viscosity of honey

Viscosity of honey was measured following Oswald's viscometer method of [10].

Ash content

Ash content was measured by calcination, overnight, in furnace at 550 °C, until constant mass [11].

Density

Density of honey was measured by specific gravity bottle 5ml. density model (SHIMADZU AX-200).

Calculation of surface tension of honey

The capillary drop weight is used to calculate the surface tension of honey.

pH

pH was measured in a pH-meter (Hanan M-22054) from a solution containing 10 g of honey in 75 ml of CO₂-free distilled water [12].

Statistical analysis of data

Data of all four physical characteristics were analyzed by F-test. The analysis of variance (ANOVA) along the F-test was calculated and significant levels were determined using F-table (P<0.01 and P<0.05).

RESULT

The mean results and basic statistics obtained for various physico-chemical parameters of the two samples of *A. mellifera* and *A.*

cerana, collected from different regions of Anantnag district, Jammu and Kashmir are summarized in Table 1 and Figure 1. The results have shown that the moisture content, ash content, pH, and density of *A. cerana* were slightly higher than that of the *A. mellifera*. While viscosity, surface tension, optical density and refractive index of *A.*

mellifera were found to be 3.017, 1.03, 1.061 and 2.235 respectively and were higher than that of the *A. cerana*. Analysis of variance and F-test have shown that moisture content, surface tension, ash content and pH of these two samples of *A. mellifera* and *A. cerana* differ significantly (Table.1 and Fig. 1)

Table 1: Physico-chemical characteristics of honey samples of *A. mellifera* and *A. cerana* collecting from different regions of district Anantnag (Jammu and Kashmir).

Parameters	Honeybee species		F-ratio	P value
	<i>A. mellifera</i>	<i>A. cerana</i>		
Moisture (%)	7.5 ±0.01	8.5 ±0.34	84.1*	<0.05
Viscosity	3.017 ±0.3	2.945 ±0.4	0.073	>0.05
Surface tension	1.03 ±0.4	0.103 ±1.3	6403.6*	<0.05
Optical density	1.061 ±1.3	1.056 ±1.7	0.552	>0.05
Refractive index	2.2350±0.9	2.2305 ±0.3	0.479	>0.05
Ash content	0.85 ±3.2	1.05 ±2.3	72.00*	<0.05
pH	4.0 ±0.5	4.7 ±3.5	72.25*	<0.05
Density	1.060 ±0.2	1.056 ±0.7	1.142	>0.05

* Significant at p<0.05

Mean ±S.D

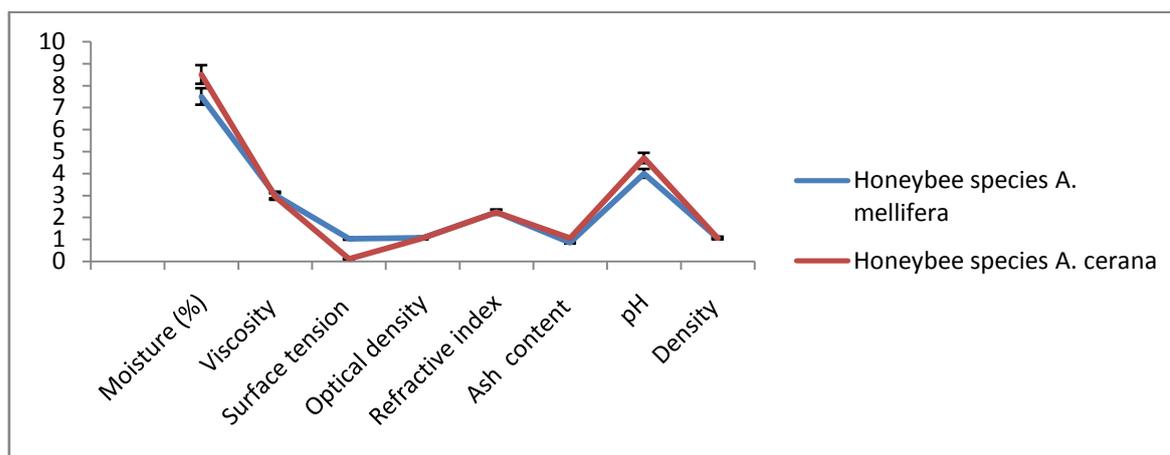


Fig. 1: Physico-chemical characteristics of honey samples of *A. mellifera* and *A. cerana* collecting from different regions of district Anantnag (Jammu and Kashmir).

DISCUSSION

Physico-chemical analysis of honey is based on various physico-chemical characteristics and it enables to form standards for genuine honey samples of any region. Moreover, the physico-chemical data of any honey sample is essential for storage purpose and marketing [13].

Moisture content

Moisture content plays an important role in preservation of honey. If the moisture content exceeds 22 per cent, honey is likely to ferment [14].so, for preservation, honey of higher moisture content requires the lowering of moisture content. The moisture content of the two present honey samples had a value of 7.5% to 8.5% in *A. mellifera* and *A. cerana* from district Anantnag (J& K) respectively (Table 1 and Fig. 1).The average moisture content of honey extracted from *Apis cerana indica* and *Apis mellifera* as reported by different authors was 19.98 and 17.14 per cent in honey samples of north India [15] and according to [16], it varied from 16.60 to 26.40 per cent. These values were lower observed in the present samples. Moisture content varied from 20-24 in Taiwan honey [17] and similar moisture content was reported in Japanese honey by [18].Comparatively lower values of moisture content have been reported in honey samples from many other countries .for example, the average percentage for America honey samples was 16.72 [19] and in spanish honey it ranged from 14.5 to 21.6 per cent . The lower moisture content of present honey samples may be influenced by the time of extraction from the comb in relation to ripening process by

the bees, climatic factors, storage conditions, more humid conditions before and after honey removal from the hive are likely to increase the moisture content and vice-versa [10].

Viscosity

Viscosity of *A.cerana* honey had a value of 2.945 and viscosity of *A.mellifera* honey was 3.017 (Table 1 and Fig.1). The analysis of variance of moisture levels of honey from two honeybee species was significant at 0.5% level. Viscosity of honey also depends on the nature of nectar. The viscosity of honey is mainly due to high sugar concentration [20]. Viscosity is measure of the resistance of fluid to flow caused by internal friction, which results in different rates of flow in different parts of the liquid, denoted by η (eta). Viscosity of honey samples decrease with the increase in temperature. Summer honey samples had more viscosity than autumn honey. Higher viscosity of honey causes severe problems during straining, processing and storage. The analysis of variance of moisture levels of honey from

Surface tension

Surface tension of honey affects its processing. Low value of surface tension may lead to excessive foaming and scum formation. [21] noted that when the surface tension of per cent solution of seven floral honey and honey dew honey was changed from 41.02 to 60.2 dynes/cm, foaming and retention of air bubbles decreased. In the present analysis, surface tension at 30° c for *A.cerana* sample of honey is 0.103 and 1.03 for the honey sample of *A.mellifera*. Surface

tension is a complex phenomenon and is influenced by mineral constituents and all other active minor honey constituents which may be surface active. Substances which distribute themselves uniformly throughout solution raise the surface tension. Whereas, surface accumulating substances lower its value (Gibbs-Thomson rule) so, surface tension of both samples showed significant correlation with other characteristics of honey samples. Surface tension is film-like tension on the surface of honey that is caused by the cohesion of its sugars and other constituents, which has the effect of minimizing its surface area. Generally honeys with higher water levels have higher surface tension than honeys with lower water levels [22].

Optical density

Optical density of *A.cerana* honey had a value of 1.056 and *A. mellifera* honey was 1. (Table.1 and Fig.1). The analysis of variance of optical density levels of honey from two honeybee species was not significant at 0.5% level. The optical densities of all honey samples are laevorotatory because of high levels of laevulose [23]. Fresh and lighter honeys have less O.D compared to dark and stored honey samples. Generally, lighter honeys have more consumer demand than darker honey [24].

Refractive index

Refractive index of *A.cerana* honey was 2.2305 and *A.mellifera* honey had a value of 2.2350 (Table 1). The analysis of variance of refractive index of honey from two honeybee species was not significant at 0.5% level. Refractive index is the measure of ratio of velocity of light in free space to that of honey. Similar results were reported by [25] in Venezuelan honeys where the refractive index was 1.499. Further, results suggest that all physical and chemical characteristics of honey differ with variations in refractive index. Refractive index increases due to the presence of sugars like laevulose and dextrose besides minerals and amino acids in honey samples. There is no significant correlation between refractive index of honey and altitude [26]. Lesser refractive index indicates higher moisture content and higher refractive index denotes lower moisture content of honey [27] reported that slight decrease in refractive index due to rise in temperature of 20°C.

PH

Honey pH values of *Apis cerana* & and *Apis mellifera* varied from 4.7 to 4.0. Published reports indicate that pH should be between 3.2 and 4.5 [28]. Some honeys, such as chestnut and fir honey have been shown to have high pH values viz. 5-6 and 4.6-5.9, 149 respectively [28]. The pH values of the 2 honeys were similar to those of honey from the Czech Republic (4.53) [29] and some Moroccan honeydew honey [30]. The pH content of honey varied between 4.7 and 4.0 in *A. cerana* and *A. mellifera* from different regions of district Anantnag Kashmir respectively (Table.1 and Fig.1). The analysis of variance of pH content of honey from two honeybee species was significant at 0.5 % level. [31] reported pH in the honey in range of 3.61 – 4.97.

Ash content

The ash content of *Apis cerana* and *Apis mellifera* honey samples varied from 1.05 to 0.85. High ash content has been obtained in Moroccan and Czech honeydew honeys [30]. Ash content is one of these parameters that have been associated with botanical and geographical origins of honey samples. The ash content in honey is generally small and depends on nectar composition of predominant plants in their formation [32]. In our study, ash content of samples was in the acceptable range. These results are good agreement with those of [33-35]. Moreover, no significant differences were observed.

. The ash content is a measure of mineral content of honey. Though the quantities of minerals are less, they play a vital role in determining the color and nutritional value of honey. [36] Found that mineral content of honey from Spain varied from 0.06% to 1.34% in *A. mellifera* species. Variations such as aroma, flavor, medicinal value and keeping qualities of honey are largely dependent on the mineral content of honey [24]. Mineral content of honey was highly variable with the species of honeybee, seasons, color and geographical zones.

Density

Density of honey is an important factor, it may increase or decrease with the increase in moisture content and vice versa. The density of two present honey samples of two species measured was 1.056 and 1.060 for *A.cerana* and *Apis mellifera*.

CONCLUSION

In conclusion several physico-chemical properties of two honey samples were studied. These honey samples were taken from same environmental and geographical area of Anantnag district, Kashmir. The results of the study indicated the variability in honey sample analysis test. Analysis of honey sample revealed that floral source and environmental conditions has an important role in quality parameters pertaining to processing and storage. This study demonstrated that the honey samples varied significantly. The studied samples are found to be in low moisture content and therefore safe for fermentation. The obtained results could be used for processing, product development and storage of honey and honey products. These results indicate a high quality of honey, which is needed for medicinal treatment and international trade. The results have to assess the quality of Kashmir honey and establish some guidelines for confirmation of the quality.

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