CHEMICAL ANALYSIS OF HONEY OF APIS CERANA F. AND APIS MELLIFERA FROM PLAINS OF JAMMU AND KASHMIR AND TAMIL NADU

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ABSTRACT

The present study was aimed to determine the chemical analysis of honey collected from plains of Tamil Nadu and Jammu and Kashmir. The four honey sampled were analyzed for their chemical analysis i.e. moisture, pH, ash content, reducing sugar, laevulose, glucose, fructose, dextrose, diastase, and free acidity. The chemical properties of honey with high frequency were moisture (21.9±0.48%), pH (4.65±0.02%), ash content (1.17±1.8%), reducing sugar (70.77±3.95%), laevulose (39.45±1.55%), glucose (34.99±0.54%) fructose (37.81±0.55%), dextrose (34.81±1.02%), diastase (16.39±0.75%), free acidity (24.23±0.04%) in A. cerana from plains of Tamil Nadu as compared to the rest of three samples. The chemical properties of all the samples were within range and varied highly significantly at the level (P≤.000).The present study indicated that Indian honey is good in quality and safe for the commercialization.

KEYWORDS: A. cerana, A. mellifera, Chemical Analysis, Plains of Tamil Nadu and J&K

INTRODUCTION

Honey, as defined by the Codex Alimentarius (1989) is the natural sweet substance produced by honeybees from the nectar of blossoms or from the secretion of living parts of plants or excretions of plant-sucking insects living on parts of plants, which honey bees collect, transform and combine with specific substances of their own, store and leave in the honey comb to ripen and mature. Honey is a complex mixture and presents very great variations in composition and characteristics due to its geographical and botanical origin (Crane, 1975, 1980; Ramirez 2000; ANONN, 2003; 2001-2004), its main features depending on the floral origin or the nectar foraged by bees. Honey possesses valuable nourishing, healing and prophylactic properties (Pereira, P.C.M et al 1998). These properties can be interpreted by its physical and chemical composition.

The composition and quality of honey also depend on several environmental factors during production such as weather and humidity inside the hive, nectar conditions and treatment of honey during extraction and storage. Major chemical components of honey include sugars which represent the largest portion about 82% of honey composition (Hack-Gil et al 1988). The composition of honey depends on the type of flowers visited by bees, climatic conditions in which the plant grow and maturation (Abou-Tarboush et al 1993, Anklam, E., 1998). Since the forage area of the hive is more than 7 km² and the bees come in contact with air, soil and water, the concentration of minerals in honey reflects their amount in the whole region (Przybylowski, P. and Wilczynska, A., 2001, Atrouse, O.M., et al 2004). The chemical analysis of honey is important to the honey industry, as these factors are intimately related to storage quality, granulation, texture, flavor, and the nutritional and medicinal qualities of honey.

The aim of the present study was to characterize the chemical parameters of the honey samples of two indigenous honey bee species Apis Cerana . And Apis mellifera collected from plains of Jammu and Kashmir and Tamil Nadu, and to
study the quality of analyzed honey samples.

MATERIALS AND METHODS

Honey samples were collected from plains of Jammu and Kashmir and Tamil Nadu during the years 2012-13. All honey samples were raw and unprocessed and were stored at 0 °C until analysis, which occurred no longer than one month after extraction from the hives by beekeepers.

The methods used for the characterization of honey are those as recommended by International Honey Commission (Bogdanov et al., 1999). Moisture content was determined by refractometry, using an Atago (Japan) model IT Abbe refractometer. All measurements were performed at 25 °C. 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 (AOAC, 1990).

Ash content was measured by calcination, overnight, in furnace at 550 °C, until constant mass (Luís R. Silva a et al 2009). Diastase: The diastase of honey samples was measured according to the procedure of Schade et al. (1958) and Siegenthaler (1977), respectively.

The sugars in honey samples were estimated by high performance liquid chromatography by using the column Aminex HPX-87H (Column dimensions, 300x7.8 mm) Chromatogram Index, OA3; Mobile Phase, 0.001 M H\textsubscript{2}SO\textsubscript{4}; Gradient, isocratic elution; Flow rate, 0.6 ml/min; Temperature, 46°C; Detection, RI @ 32x.

This procedure of sugar analysis by HPLC is based on Lopez and Gomes (1996). The free acidity, were quantified volumetrically, titrating a honey sample with a solution of 0.05 N NaOH, up to pH 8.3, and expressing the results in milliequivalent of acids at 1000g of honey. (Rauf Shakoori et al 2008).

Statistical Analysis

Data of the chemical parameters of honey samples was analyzed by F-test. The analysis of variance (ANOVA) along the F-test was calculated and significant levels were determined using F-table (P≤0.000).

RESULTS AND DISCUSSIONS

The mean results and basic statistics obtained for various Chemical Contents of the honey samples of A. cerana and A. mellifera , collected from different regions of Jammu and Kashmir and Tamil Nadu are summarized in Table (I, 2) and Figures (I,II,III,IV).

<table>
<thead>
<tr>
<th>S. No</th>
<th>Parameter</th>
<th>Honey Bee Species of Jammu &amp; Kashmir</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A. cerana</td>
</tr>
<tr>
<td>1</td>
<td>Moisture (%)</td>
<td>8.9 ±0.32</td>
</tr>
<tr>
<td>2</td>
<td>pH (%)</td>
<td>4.9 ±0.02</td>
</tr>
<tr>
<td>3</td>
<td>Ash Content (%)</td>
<td>1.07 ±1.4</td>
</tr>
<tr>
<td>4</td>
<td>Reducing Sugars (%)</td>
<td>65.9 ±3.82</td>
</tr>
<tr>
<td>5</td>
<td>Laevulose (%)</td>
<td>37.44 ±0.36</td>
</tr>
<tr>
<td>6</td>
<td>Glucose (%)</td>
<td>33.87 ±3.62</td>
</tr>
<tr>
<td>7</td>
<td>Fructose (%)</td>
<td>35.81 ±3.06</td>
</tr>
<tr>
<td>8</td>
<td>Dextrose (%)</td>
<td>32.97 ±0.91</td>
</tr>
<tr>
<td>9</td>
<td>Diastase (%)</td>
<td>14.46 ±0.38</td>
</tr>
<tr>
<td>10</td>
<td>Free acidity (%)</td>
<td>21.17 ±0.06</td>
</tr>
</tbody>
</table>

Highly significant (P≤0.000)
Chemical Analysis of Honey of Apis cerana F. and Apis mellifera from Plains of Jammu and Kashmir and Tamil Nadu

Figure 1 & 2: Chemical Analysis of Honey of Apis cerana and Apis mellifera Collected from Plains of Jammu & Kashmir in the Year 2012-13

Table 2: Chemical Analysis of Honey of Apis cerana and Apis mellifera Collected from Plains of Tamil Nadu in the Year 2012-13

<table>
<thead>
<tr>
<th>S. No</th>
<th>Parameter</th>
<th>Honey Bee Species of Tamil Nadu</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Apis cerana</td>
</tr>
<tr>
<td>1</td>
<td>Moisture (%)</td>
<td>21.97 ±0.48</td>
</tr>
<tr>
<td>2</td>
<td>pH (%)</td>
<td>4.65 ±0.02</td>
</tr>
<tr>
<td>3</td>
<td>Ash Content (%)</td>
<td>1.17 ±1.8</td>
</tr>
<tr>
<td>4</td>
<td>Reducing Sugars (%)</td>
<td>70.77 ±3.95</td>
</tr>
<tr>
<td>5</td>
<td>Laevulose (%)</td>
<td>39.45 ±1.55</td>
</tr>
<tr>
<td>6</td>
<td>Glucose (%)</td>
<td>34.99 ±0.54</td>
</tr>
<tr>
<td>7</td>
<td>Fructose (%)</td>
<td>37.81 ±0.55</td>
</tr>
<tr>
<td>8</td>
<td>Dextrose (%)</td>
<td>34.81 ±1.02</td>
</tr>
<tr>
<td>9</td>
<td>Diastase (%)</td>
<td>16.39 ±0.75</td>
</tr>
<tr>
<td>10</td>
<td>Free acidity (%)</td>
<td>24.35 ±0.04</td>
</tr>
</tbody>
</table>

Highly significant (P≤.000)

Figure 3 & 4: Chemical Analysis of Honey of Apis cerana and Apis mellifera Collected from Plains of Tamil Nadu in the Year 2012-13

From the results obtained, the chemical properties of honey from four honey samples varies from one sample to another depending upon floral origin, temperature conditions, and extraction and storage techniques. The basic statistical data obtained for the content of Moisture, pH, Ash content, Reducing sugar, Laevulose, Glucose, Fructose, Dextrose, Diastase, Free acidity with mean content values ranging from 7.7-21.97%, 3.54-4.65%, 0.89-1.17%, 64.71-70.77%, 35.91-39.45%, 32.74-34%, 99,35.64-37.81%, 31.77-34.81%, 13.19-16.39% and 21.17-24.25% respectively. The Apis cerana from Tamil Nadu region has higher concentration of chemical contents as compared to the rest of the honey samples. Analysis of variance along with F test has shown that mineral contents of all the honey samples varied highly
DISCUSSIONS

The moisture content of present honey samples had a value of 7.7% to 8.9% in *A. mellifera* and *A. cerana* from Jammu and Kashmir and 20.55% to 21.97% from Tamil Nadu (Table 1, and Fig III, IV). Jasim et al., (2007) reported moisture content to 20.12 ± 2.66% and 21.51 ± 2.38% in *A. cerana* and *A. dorsata* honey respectively. Moisture content plays an important role in preservation of honey. If the moisture content exceeds 22 per cent, honey is likely to ferment. Marvin, G.E (1933) . 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% in honey samples of North India Phadke, R.P (1967) and according to Mallick, A.K. (1958) it varied from 16.60 to 26.40%. Moisture content varied from 20-24% in Taiwan honey Lin, Y.C., Shew et al. (1969) and similar moisture content was reported in Japanese honey by Iwaida M et al (1969). In our study the values of moisture content are comparable to the values of 20-24% and 7.5-8.5% as reported earlier by Lin, Y.C., Shew et al (1969) and Mudasar et al. (2013).

The pH content of present honey samples of *Apis mellifera* and *Apis cerana* varies from 4.2 to 4.9% from Jammu and Kashmir and 3.54 to 4.65% from Tamil Nadu (Table 2 Fig I,II). The pH values of the present honey samples were similar to the values (4.53%) as reported earlier by Celechovoska O and Vorlova L (2001) And some Moroccan honeydew honey 3.61-4.97%, Diez, M. J. et al (2004). Gurel et al., (1998) reported pH in the honey in range of 3.61 – 4.97%. The analysis of variance of pH content of present two honey bee species was highly significant at (P≤ .000) % level.

The ash content in honey is generally small and depends on nectar composition of predominant plants in their formation Marvin, G.E (1933). The Ash content of *A.mellifera* and *A. cerana* honey samples varied from 0.89-1.07%, (Table 1,2). High ash content has been obtained in Moroccan and Czech honeydew honeys Diez, M. J et al (2004).

In our present honey samples, ash content was in the acceptable range. These results are good agreement with those of Nanda, V et al (2003), Sahinler, N., et al (2004), Found that mineral content of honey from Spain varied from 0.06% to 1.34% in *A. mellifera* species. Variations such as aroma, flavour, medicinal value and keeping qualities of honey are largely dependent on the mineral content of honey Wakhle, D. M. 1997.

The total reducing sugar of present honey samples of *A. cerana* and *Apis mellifera* varied between 64.71-65.9% from Jammu and Kashmir and 68.87-70.77% from Tamil Nadu respectively (Table 1,2). The analysis of Variance of total reducing sugar of present honey samples was highly significant at .000 level.

The laevulose content of present samples ranged between 35.91-37.44% from Jammu and Kashmir and 36.97-39.45% from Tamil Nadu respectively, (Table 1 and Fig III, IV). The analysis of variance of laevulose content of present honey samples was highly significant at (P≤ .000) levels. In the present study, the laevulose level is more than that of dextrose which is characteristic feature of all non-granulating, non-fermenting and authentic honey (Terrab et al., 2002). The laevulose in all honey samples was more than dextrose which is highlighting nature of genuine honeys, M. V. Balasubramanyam (2011).

Glucose and fructose are the major constituents of honey. The glucose and fructose contents of present honey samples ranged from 32.74-33.87% and 35.64-35.81% from Jammu and Kashmir and 33.65-33.87%, and 36.22-37.81% from Tamil Nadu respectively (Table 1,2). These values are similar to the values as recorded earlier by Makhloufi et al. (2007) from Algerian honey.

The dextrose content of present samples of *A. cerana* and *A. mellifera* varies between 31.77-32.97 % from Jammu.
and Kashmir and 32.79-34.81% from Tamil Nadu respectively (Table 2, and Fig I, II). The analysis of variance of dextrose content of present honey samples was highly significant at (P≤ .000) levels.

Diastase content of present honey samples varied between 13.19-14.46% from Jammu and Kashmir and 14.54-16.39% from Tamil Nadu respectively (Tale 1, 2). And these values are similar to the values 16.27 as reported earlier in Turkey by, Turhan, K., (2007).

The free acidity content of present honey samples varied between 21.15-21.17% from Jammu and Kashmir and 23.19-24.23 from Tamil Nadu respectively (Table 1,2).and these values are close related to the values 21.15-27.2% as reported earlier in Spain by Terrab, A., et al (2004). According to Agmark specifications, the maximum limit of acidity is 0.3%. Acidity of honey is due to the presence of formic, butyric, acetic and lactic acids due to the action of osmophilic yeasts and sugar-tolerant bacteria which readily act on honey sugars (Balasubramanyam and Reddy, 2003). Generally, Indian honeys possess higher acidity as compared to foreign samples due to tropical climatic conditions. Further, it has been also reported that fresh honeys, M. V. Balasubramanyam (2011).

CONCLUSIONS

The present study was undertaken to analyze and compare the chemical parameters of honey samples, from plains of Tamil Nadu and Jammu and Kashmir. All the honey samples were equally good in quality. This study also would be helpful to know the honey freshness, good conservation, how to protect honey from microbiological activity and for commercialization purposes.

REFERENCES


