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STUDIES ON PHYSICAL PROPERTIES OF HONEY COLLECTED FROM DIFFERENT PARTS OF ODISHA

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ABSTRACT

The honey samples of *Apis cerana indica* and *Apis mellifera* collected from 18 different locations of Odisha revealed that physical properties viz., moisture content (%), pH, acidity (%), colour (Refractometer reading-Pfund scale) of the collected apiary honey samples varied from 18.4 to 27, 4.01 to 5.37, 0.19 to 0.68 and 0.217 to 2.00, respectively. Moisture content and colour properties satisfy the standards of ISI specification of Indian honey under A grade, special grade and standard grade.

Key words: Honey bee, *Apis cerana indica, Apis mellifera,* physical properties, moisture, acidity, pH, colour, apiary, honey

Honey bees are the eusocial hymenopterans which are entirely dependent on nectar and pollen resources for their dietary requirement. They are unique, which support life on earth through their free pollination services in nature. Nevertheless, they are important as producers of various hive products viz. honey, wax, pollen, propolis, royal jelly and venom which remains the primary objective of beekeepers practicing beekeeping. Among the products, honey is a natural gift having immense value to mankind. Honey bees collect and store surplus honey in the beehive. The honey is produced by different species of honey bees from the nectar of flowers, nectar glands of plant parts and honey dew of sucking insects. These substances are collected by honey bees which are processed and transformed into ripened and matured honey by combining with specific substances of their own in the honeycomb (Codex Alimentarius, 2001). These honeys vary widely with respect to its physical and chemical properties. Though the precise composition of honey varies according to the plant species on which the bee forages, the main constituents are the same in all honeys. On an average, honey is composed of moisture (17.2%), fructose (38.19%), glucose (31.28%), sucrose (1.31%), disaccharides calculated as maltose (7.31%), higher sugars (1.5%), free acid as gluconic (0.43%), lactone as gluconolactone (0.14%), total acid as gluconic (0.57%), ash (0.16%) and nitrogen (0.041%) (Jeffrey and Echazarreta, 1996).

Eighteen number of honey samples from *Apis cerana indica* and *Apis mellifera* apiary were freshly collected in sterilized containers with proper labeling and stored with necessary precaution to maintain the quality of honey throughout the research work. The moisture content in honey samples were determined by measuring the refractive index with the help of an Erma make hand refractometer with 58-92% of range and using the appropriate conversion table thereof. The refractometer readings of each honey sample were recorded at monthly intervals commencing from July to November, 2019. Honey samples weighing 10 g were taken in a 100 ml beaker using an analytical balance and the samples were homogenized in 50 ml of distilled water. Thereafter, using a pH meter calibrated with appropriate buffers (pH solution of 7.0 and pH solution of 4.0) for each honey sample, a direct reading is taken from the device at room temperature. The % acidity was determined by taking 10 g of honey from each sample, were thoroughly dissolved in 100 ml distilled water in volumetric flask and titrated against standard sodium hydroxide solution. Then carefully neutralized with phenolphthalein solution (till the pink colour of indicator persisted for at least 10 seconds). The % acidity was calculated by using the following formula.

Acidity % = (Titre X Normality of alkali X Volume made up X Equivalent weight of acid) X 100

The evaluation of honey colour was determined

based on absorption of light of various wavelengths, depending upon the constituents present in the honey by visible spectrophotometer at wavelength of 560 nm and compared to an analytical grade glycerin as a blank sample. The honey was transferred to the cuvette and observation taken from the instrument display and value was coordinated with the Pfund scale expressed in millimeter (mm) to determine the colour according to approved colour standards (Devillers et al., 2004).

The study revealed that moisture content of the examined honey samples ranging between 18.6 and 26% for *A. c. indica* and 18.4 -27% for *A. mellifera* are befittingly within the specified range. Moisture content plays an important role in preservation and determining the shelf stability of honey (Azeredo et al., 2003). High moisture content renders honey liable to fermentation in storage by osmotolerant yeasts, spoilage and flavour loss resulting in a significant decrease in quality (Costa et al., 1999 and Viuda-Martos et al., 2010). A high moisture content of honey can also be an indicator of contamination (Nyau et al., 2013). The highest moisture content with 26% was recorded from Balanga, Puri, followed by 25% from Odosingha, Narasinghpur and Bhagatpur, Bhadrak; 24% from Parlakhemundi; 23.5% from Balliguda, Bhadrak; 23% from Kishanagar, Cuttack; 22.5% Bhubaneswar; 22.0% from Dhamnagar, Bhadrak and Mahulpalli, Sundergarh; 21.5% from Arjunpur, Bhadrak and the least moisture content with 18.6% from Khandagiri, Bhubaneswar (Fig. 1).

The honey samples collected from apiary of Khandagiri, Bhubaneswar and AICRP on Cashew, Bhubaneswar with moisture content of 18.6 and 18.4%, respectively were categorized as special grade based on ISI specifications. Honey samples examined with moisture content 22.0% from Dhamnagar, Bhadrak and Mahulpalli, Sundergarh; and 21.5% from Arjunpur, Bhadrak were categorized as A grade. Whereas, sample with moisture content more than 22.0% were examined from honey collected from different geographical locations were categorized as standard grade. The moisture content of honey samples is important as it contributes to its ability to resist fermentation and granulation during storage (Singh and Bath, 1997), which depends on botanical origin of honey, harvest season, the degree of honey maturity, degree of ripeness, processing techniques and storage conditions. Further, moisture content was also affected by climate, season, and moisture content of original plant nectar (Finola et al., 2007). The findings of Gulati and Kumari (2005) were in line with the present investigation of apiary honey with moisture content ranging between 22.8 and 25%. The pH values of eighteen honey samples were evaluated and the results obtained confirmed that, all the examined honey samples were acidic (pH 4.01-5.37) (Fig. 1) and fall within the prescribed acidic range of 3.5 -5.50 (Bogdanov et al., 2004), that confirms honey samples' freshness. Among the honeys of *A. c. indica* the most acidic honey was obtained from Odosingha Narasinghpur follwed by Parlakhemundi (4.07). Whereas, the honeys obtained from *A. mellifera* apiaries examined with the acidity ranged between 4.08 and 4.67 from Janiguda, Koraput being the higest and Chindri, Koraput the lowest. There is a specific difference between honey samples of *A. c. indica* and *A. mellifera.* The Acidity of *A. c. indica* honey samples

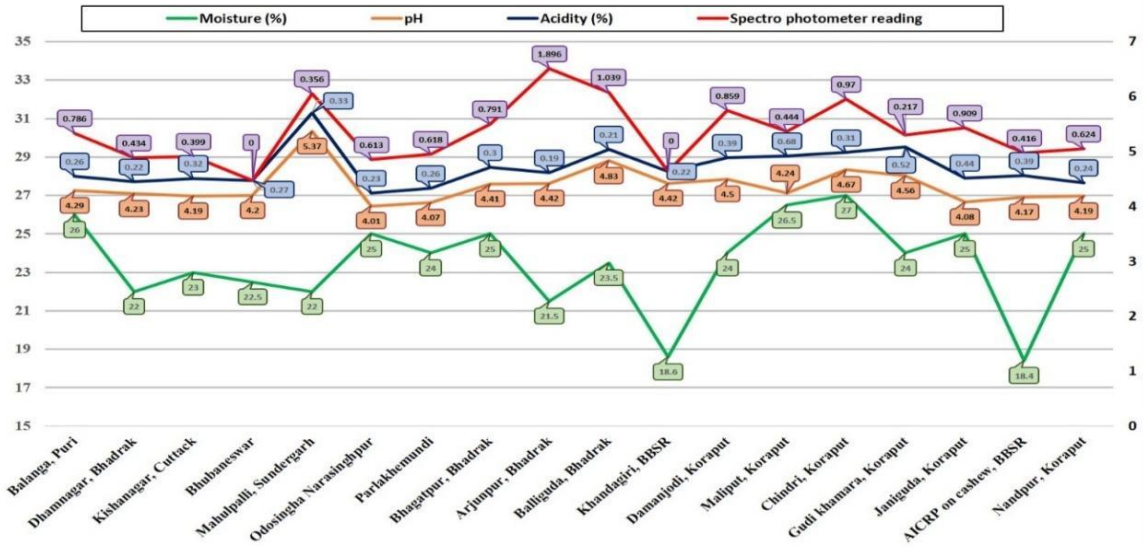

Fig. 1. Physical properties of apiary honey samples collected from different locations of Odisha

ranged between 0.19% in Arjunpur, Bhadrak and 0.33% in Mahulpalli, Sundergarh honey samples. The Acidity of honey samples obtained from *A. mellifera* apiaries ranged from 0.24% (Nandpur, Koraput) to 0.68% (Maliput, Koraput). Lazarevic et al., 2012 reported that the pH of apiary honeys ranged from 3.17 to 5.85. The acidity of honey is due to the presence of organic acids, particularly gluconic acid; and inorganic ions such as phosphate and chloride (Nanda et al., 2003).The results revealed that the acidity of apiary honey samples was within the acidity range which correlates with the extended shelf life of the honey and thus prevents spoilage by microorganisms (Bogdanov et al., 2008). The findings are in line with the assertion of William et al., 2009; Shahnawaz et al., 2013 and Gulati and Kumari (2005). In the present study, variations observed in the acidity level of different honey samples may be due to the effect of fermentation.

Colour has a direct impact on the price of honey as it influences consumer preference and is of particular importance in the international market. Variations in the colour of honey are related to its floral origin, mineral content, storage and product processing, climatic factors during nectar flow and the temperature at which the honey matures in the hive, as well as factors such as the proportion of fructose and glucose present, nitrogen content and the instability of fructose in an acid solution (Bath and Singh, 1999). The spectrophotometer readings of the honey samples were in the range of 0.217-2.00. The apiary honey samples collected from different locations of Odisha ranged from dark amber to light amber and amber. Eight honey samples collected from Balanga, Odosingha, Parlakhemundi, Bhagatpur, Damanjodi, Maliput, Janiguda and Nandpur of Odisha fall under category amber, while five samples from collected from Dhamnagar, Kishanagar, Mahulpalli, Gudi khamara and AICRP on cashew, Bhubaneswar fall under light amber and five samples from Bhubaneswar, Arjunpur, Balliguda, Khandagiri and Chindri fall under dark amber categories. Phadke (1962) reported that there was absence of Tryptophan and Tyrosine in light honeys compared to their presence in darker honeys. Colour variations observed in the present study findings were similar to the results found by the Al-Doghairi et al. (2007) as 23 natural honey samples were of light amber-dark amber in colour. Honey also darkens more rapidly when stored at high temperature and the length of storage time affects the honey's colour (Belay et al. 2015). Higher Pfund and colour intensity values indicate the higher content of phenolic compounds and flavonoids (Moniruzzaman et al., 2013).

It is concluded from the study that by considering all the characters of the honey sample of *Apis cerana indica* collected from the location Khandagiri, Bhubaneswar, Odisha, satisfy the standards of ISI specification under special grade.

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