

BIOCHEMICAL STUDIES ON HONEY

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I N T R O D U C T I O N

INTRODUCTION

Honey is the natural food of the honey bee, gathered by them as nectar from the nectaries of plants, modified and stored in their combs.

The process by which bees convert nectar into honey consists primarily of inverting most of the sucrose in nectar to the simple sugars dextrose and levulose, by the use of enzymes, and the evaporation of the excess water to a consistency generally sufficient to prevent fermentation. It can be also be defined in more inclusive way without signifying the limited amount of the different constituents as follows. Honey is an aromatic, viscid, sweet material derived from the nectar of plants through the collection of honey bees, modified by them for food into a denser liquid and finally stored by them in their combs, ^{it has an} ~~an~~ acid reaction, ~~liquid~~ in its original condition but becoming crystalline on standing. ^{Honey} consists chiefly of two simple sugar, dextrose and levulose, with occasional more complex carbohydrates, with levulose usually ^{predominant} ~~predominant~~, and always containing material, plant colouring materials, several enzymes, and included pollen grains.

This definition is not entirely complete because it does not take into consideration the fact that tupelo and

sage honeys are relatively nongranulating, and all honeys now known to contain complex carbohydrates pollen grains are an invariable characteristic of honey but those present are not necessarily indicative of the floral source.

Honey are classified according to (1) plant source, (2) the type produced and (3) the physical condition in which the product is sold.

In order to be classified or labeled as being from a definite plant source, a honey must have the predominant colour and flavor of honey from the particular plant mentioned. Identification of the probable source of a honey is made by comparison with known samples as to typical colours, flavors, and certain physical properties Concerning the physical and chemical properties of honey, it is generally known and easily demonstrated fact that honey from different plant sources vary in aroma, flavor, colour, density, and in granulation characteristics. Various investigators have found that honeys also vary somewhat in viscosity and in their chemical content of sugars, moisture, enzymes, vitamins, minerals, acids, colloids, pigments, and percentages of unknown compounds as plant growth hormones. No two samples of honey are exactly alike, even though they

may come from the same plant source, but the observable differences may not be very great. Regarding the advantage of honey in food and medicine, it is well known that dextrose in honey can be absorbed directly into the human blood stream without further digestion, and the levulose follows with but slight modification hence the great value of honey in stomach complaints such as ulcers and in malnutrition, especially with children, and in typhoid fever. Honey is a great producer of hemoglobin in the blood. It is useful in liver and heart troubles and does not produce gas. It is good wherever maltose or sugar of milk are indicated. It may be used in baby feeding, for example, to advantage, for a nine month's child a teaspoonful being added to every 80 z. of whole milk. However, the present investigation was carried out on three different kinds of honey bees gathered from three different plant sources i.e. cotton, clover and citrus grown in the field of Moushtohor Faculty of Agriculture, Ain Shams University, to study the physical and chemical properties of each product, and how far clover bee honey as an example of such products can be adulterated by the commercial glucose and artificial glucose.

Such biochemical studies were carried out for the aim of improving this natural products commercially by adding or removing the desirable or the undesirable materials which affect the physical and chemical properties of such natural product.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Moisture :

Eckert and Allinger (1939) studied the physical and chemical properties of 37 types of California honeys, they found that the average value of moisture was 16.5. These findings were in agreement with that reported by Andrson and Perold (1964), and ^{Abdul} Latef, et al. (1966).

^{Chandra} ~~Abdul~~ (1960) showed that the Indian honey contained 11.13 moisture. However, Japanese honeys were analysed by Watanabe et al. (1961) and showed that the moisture content was 21.65. Moreover, Estienne (1964) stated that honey's moisture content was 20.24. Certain Romanian honey's analysed by Baculinschi (1961) showed that the average values of moisture was 16.5, 17.58, 17.33, 16.71 and 17.93 in acacia, linden, clover, sunflower and raspberry respectively. These results were confirmed with that stated by Flechtman ~~an~~ et al. (1963).

Carbohydrate Fractions :

Carbohydrate fractions are the major constituents of the honey. They are considered from the nutritional

point of view the main source of energy in the body.

Jokert and Allinger (1969) studied the physical and chemical properties of 37 types of California honeys, they found that the average percentage of total reducing sugars, levulose, dextrose, sucrose, and dextrin was 77.53, 40.41, 35.54, 2.53, and 0.91 respectively. Also ^{Abdul} Latif et al. (1956) found that these amount in Pakistan honey was 71.1 - 76.90 total reducing sugars, 39.01 - 53.8 levulose, 27.7 - 34.2 glucose and 1.9 - 2.75 sucrose. However, Estienne (1964) studied the chemical composition of honey and found that: glucose 35.40, fructose 34.9, sucrose 6.39, and dextrans 0.80. Moreover Baculinski (1961) analysed various Romanian honeys and found that the average values percent of invert sugar, glucose, fructose, sucrose and dextrans given: acacia 76.13, 35.31, 40.22, 3, and 3.08; linden 76.26, 37.32, 38.94, 2.44, and 2.52; clover 76.4, 37.68, 38.70, 2.4, and 2.77; sunflower 76.94, 38.47, 37.34, 2.34 and 2.75; raspberry 74.4, 36.37, 38.01, 2.58, and 3.63.

^{and Zucker}
Hadorn (1963) recorded that more than 8 % sucrose in honey indicates that the bees have been fed sugar.

A chromatographic method developed by Taufel and Reiss (1952) has indicated that at least 5 saccharides other

from these commonly known present (glucose, fructose, and
maltose) can be found in bee honeys. The tests also showed
that sucrose does not occur in all honeys.

The chemical analysis of honey based on paper chromatography method is described by Galanti and Wernimont (1958). Six sugars were found to be present: raffinose, melezitose. Also six disaccharides were isolated from honey and identified by their infrared spectra by Jonathan and Hoban (1959) as isomaltose, maltulose, turanose, nigerose, maltose and sucrose. The first 4 have not been previously identified in honey.

Paper chromatographic analysis of American honeys by Jonathan (1961) from all over the states showed (in varying amounts): Levulose, dextrose, succrose, maltose, isomaltose, turanose, maltulose, and dextrantriose to be present in all honeys. Most sugar probably do not occur in the nectar but are formed during ripening aging of the honey.

Chromatographic studies also were carried out on 80 samples of honey from various parts of Bulgaria by Sorokir (1962) showed that in 76 of the 80 samples, ^{studied} fructose and glucose were present. In 4 samples where the honey