J. Plant Prot. and Path., Mansoura Univ., Vol. 1 (10): 815 - 823, 2010

STUDIES ON SOME PHYSICAL AND CHEMICAL PROPERTIES OF CLOVER HONEYS IN EGYPT

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ABSTRACT

This studies aimed to determi.ne physical and chemical properties of clover honeys in Egypt. Eleven clover honeys samples from different governments in Egypt were analyzed results are presented from specific gravity, viscosity (Poise)color, granulation , EC (ppm),TSS % , moisture % ,pH ,free acidity mq/kg, lacton mq/kg, total acidity mq/kg ,fructose %, glucose %, sucrose % and maltose % .

The results indicated that specific gravity was parallel and ranged from 1.4548 to 1.4050 with mean 1.4100, viscosity from 34.9 to 93.05 with mean 46.93(Poise), color from 0.14 to 0.36 with mean 0.23 ,granulation from 1.760 to 1.437 with mean 1.630, EC from 247.5 to 100.0 ppm with mean 155.5,TSS from 80.38 to 82.75 with mean 81.0 % .

Chemical properties showed that moisture was parallel and ranged from 19.25 to 17.5 with mean 18.76, pH ranged from 3.70 to 4.15 with mean 3.8 ,Free acidity 76.5 to 18.5 with mean 35.31 mq/kg , Lacton 5.0 to 45.0 with mean 11.5 mq/kg ,total acidity from 81.0 to 25.5 with mean 43.75mq/kg, fructose from 40.43 to 37.57 % with mean 39.03, glucose 33.0 to 30.2 with mean 31.5% , sucrose 1.2 to 6.03 % with mean 3.56, maltose 8.0 to 3.5 with mean 5.2% and proline ranged form 51.35 to 23.55 mg/kg with mean 34.07 mg/kg.

It is clear that the biochemical variation can be useful separating at least some different honeys within different types

INTRODUCTION

Honey, a viscous and aromatic product appreciated since ancient Grecian times, is prepared by bees mainly from nectar of flowers or honeydew (Dustmann, 1993).

The characteristics of texture, appearance , flavor and sweetness of honey, as well as its medicinal properties, have attracted thousands of consumers (Dustmann, 1993 ; Zunlai & Lulat , 1989). Furthermore, a great number of consumers are aware that refined sugars is associated with empty energy and thus they are looking for other more nutrition foods . So it is anticipated that the world trade of honey which grow consistently in the future.

Chemically ,honey is quit complex. It comprised primaly sugars, however, it contains many or these potentially biologically active components, such as antioxidants, which display anti mutagenic activity (Wang *et al.* 2002).

The chemical composition of honey is complex and the contents of individual constituents vary considerably (Zander & Kocü, 1975; White, 1978). Surveys of floral honey composition have established that the three major components are fructose, glucose and water, averaging 38.2% , 31.3% and 17.2%, respectively (Doner, 1977).

The aim of the work were, determination of physical and chemical properties of clover honey in different government in Egypt and search for significant parameters in distinguishing honeys of different botanical Origin. This work was implemented in the Bee –keeping Res. Plant Protec. Res. Intst.during the year 2005.

Discriminate analysis was used to distinguish honeys, using ten (10) variables for 11 samples (clover plant sources).

MATERIALS AND METHODS

Materials

Samples of Egyptian honey were collected from eleven government in Egypt for analysis (Kafr-Elshekh, Gharbia, Suez, Dakahalia, qalubia, Sharqia, Giza, Bany-swief, Minia, Assiut and Qena).

Methods

1- Physical properties determination:

The specific gravity was measured according to (Wedmore, 1955), the viscosity was measured according to (Munro, 1943), the color was measured according to (White, 1978), the granulation was measured according to (White, *et al.*,1962) , the electrical conductivity (%) was measured according to (Vorwohl, 1964). total soluble solids (%) was measured according to(AOAC,1990)

2- Chemical properties determination:

The moisture (%), Photometrical analysis of proline, pH, free acidity (mq/kg), lactones (mq/kg) and total acidity (mq/kg) measured according to (AOAC,1990), the total soluble solids (%) was measured according to Association of Official Agricultural Chemists (The AOAC , 1980). Quantities of sugars by High Performance Liquid Chromatography (HPLC) measured the concentration of fructose, glucose , sucrose and maltose (%) according to (Bogdanov and Baumann, 1988).

RESULTS AND DISCUSSION

Tables (1&2) demonstrates that the different regions of clover honeys showed a parallel of all physical and chemical parameters of eleven Egyptian honey samples .By use of least significant differences (LSD) test for multiple comparisons , it is apparent that there was no different significances of the average of all honey parameters of different regions.

The physical properties of clover honeys :

The physical characteristics of honey clover of practical importance is honey density, expressed as specific gravity (Sg) , it depends on the water content of the honey . The densities of tested honeys (Table 1) show that ranged 1.405 – 1.4548 these densities fall within those found by White, (1975) ranging between 1.421 – 1.423 .Al-Arify (1998) found that specific gravity of Saudi honey ranged from 1.42-1.44 with mean value 1.432. Tharwat & Nafea (2006) reported that the (Sg) of tested honeys ranged from 1.42 – 1.43 . Nafea *et al* (2009) found that the specific gravity of different Libyan honey types were ranged 1.39 – 1.43. Elsharawi *et al* (2009) found that the specific gravity of different Aswan honey types were ranged 1.39 – 1.42

Viscosity is an important technical parameter during honey processing , because it reduces honey flow during extraction , pumping , setting , filtration , mixing and bottling .Results in Table (1) show that the viscosity of clover honey ranged from 34.9-93.05 poise. The highest rate of viscosity was 93.05 poise in clover honey in Minia, while the lowest rate was 34.90 poise in Qalubia (Table 1). As pointed out by (White , 1975) the variations in viscosity of honey are due primarily to temperature and water content where the viscosity values were ; 2.6 , 10.7 , 21.4 68.4 189.6 and 600.0 poise .While (Mishref *et al* ,1999) found that the viscosity of clover , cotton and sunflower honeys were 55.56 , 63.48 , and 116.0 poise , respectively . Tharwat & Nafea (2006) concluded that the viscosity values of Saudi tested honeys ranged from 87.5 – 183.0 poise. Nafea *et al* (2009) found that the viscosity values of different Libyan honey types were ranged 13.6- 87.5 pois. Elsharawi *et al* (2009) found that the viscosity values of different Aswan honey types were ranged 14.0-69.0 pois

Color (as an optical density) varies with botanical origin , age and storage condition , but transparency or clarity depends on the amount of suspended particles such as pollen . Honey varies tremendously in color and flavor, depending largely on its floral source. Its composition also varies widely, depending on its floral sources ,colors of honey from a continuous range from very pale yellow through ambers to darkish red amber to nearly black. The variation are almost entirely due to the plant source of the honey although climate may modify the color somewhat through the darkening action of heat, comb, color, color (as optical density) varies whitely botanical origin , age and storage condition, but transparency or clarity depends on the amount of suspended particles such as pollen

Thawley (1969) explained that the dark color was partially attributed to condensation between amino acids and sugars in honey of the coloring materials are plans pigments . Data presented in (table 1) showed that, the color values of eleven Egyptian honey samples ranged from 0.14 – 0.36 with mean value 0.233 . Nour (1988) reported that the range of color for clover honey was between 0.12 to 0.240. The results of color by Abd- Elbarry and Mishref (1993) for clover honey from Fayoum (0.15) . Mishref *et al*,(1999) reported that honey color ranged (0.12 – 0.24) . Tharwat & Nafea (2006) concluded that the color of Saudi honey samples ranged 0.25 – 0.94 .

Granulation . The lower the water and the higher the glucose content, the faster the crystallization . Temperature is important, since above 25 and below 5 ^{0}C virtually no crystallization occur . Granulation of Egyptian honeys tested were similar , it was ranged between 1.43 – 1.76 . Comparable results are reported by other authors (Gomez *et al.* 1993) fructose / glucose ratio of 1.93 ; Pereze *et al*. ,(1994) fructose / glucose ratio of 1.17. Tharwat & Nafea (2006) glucose / water 1.72 – 2.18 . The highest rate of granulation was 1.760 in clover honey in Dakahila, while the lowest rate was 1.437 in Suiz (Table 1).

Electrical conductivity (EC) . The high of EC values are attributed to high minerals content (Nour , 1988) . Accorti *et al.* (1986) suggested that the measurement of EC could replace that of ash content in official analytical methods . data in (Table 1) indicated that the electrical conductivity in clover

honey ranged from 100.0 – 247.5 ppm. These results were agreement with Mishref *et al*. (1999) who found that the EC of clover honey was (0.045 %). Laurrino and Gelli (2002) found that EC of citrus honey was 0.185 % . Tharwat & Nafea (2006) found that the EC of honey samples ranged 0.01 – 0.09 % . Nafea *et al* (2009) found that the electrical conductivity of different Libyan honey types were ranged 0.008-0.46 %. Elsharawi *et al* (2009) found that electrical conductivity of different Aswan honey types were ranged 0.008-0.026%

The dry matter , which should be 78 % or more , is responsible for protecting honey from fermentation .The Total soluble solids (TSS) value of honey samples were approximately the same in all honey tested (Table 1) , it was ranged from 80.38 – 82.75 % .. In this respect , Hussein (1989) mentioned that 76.83 % of T.S.S.in honey from Oman . Al-Arify (1998) found that the T.S.S of Saudi honey ranged 81.73-84.33 % . While Tharwat & Nafea (2006) concluded that the TSS content of Saudi Arabia ranged 83.0 – 84.5 %. Nafea *et al* (2009) found that the total soluble solids of different Libyan honey types were ranged 76.5-83.5%
Elsharawi *et al* (2009) found that total soluble solids of different Aswan honey types were ranged 77.088.5%

The chemical composition of the floral honeys including its contents of moisture, carbohydrate, glucose, fructose, maltose, sucrose, pH, free acidity, lactone, total acidity and proline.

The final moisture content depends not only on a number of environmental factors during production, such as weather and humidity inside the hive, but also on nectar conditions and treatment of honey during extraction and storage (Krell ,1996) .

The water contents (moisture %) of honey is important because of its effect upon keeping quality (white, 1978).

The moisture percentage (table, 2) ranged from 17.5 – 19.25 %. These results were in line with Costa *et al* (1999) found that range value of moisture 17.38-19.15 % in honey of different Brazilian regions . Nafea (2004) found that the moisture of Egyptian honey ranged from 17.0- 19.5% .While Tharwat & Nafea (2006) concluded that the moisture content of Saudi Arabia ranged from 15.5- 17.0 % . Nafea *et al* (2009) found that the moisture of different Libyan honey types were ranged 16.5 – 23.5%. Elsharawi *et al* (2009) found that moisture of different Aswan honey types were ranged 17.5-23.0%

The pH values of honeys are affected somewhat by the amount of the various acids present, but mostly by the mineral contents (Crane 1979). The values of pH of all samples tested (table, 2) ranged 3.7 – 4.15, the highest rate of pH was 4.15 in clover honey in Minia, while the lowest rate was 3.7 in Qena (Table 2), these investigation agreed with the values obtained by; Poncini and Wimmer (1983) found that the pH range of honey 3.8-4.0 . Nafea (2004) found that pH of different Saudi types honey ranged from 3.8 – 4.1

The amount of gluconic acid in honey should be a reflection of several contribution factors. This is governed by the sugar content of the nectar, the weather, the strength of the colony and the quality of nectar

flow. A greater time needed for ripening permits production of more gluconic acid, it is also results in more manipulation of the ripening honey by the bees, with addition of more enzyme (White 1978) .

Data presented in Tables (2) show that, the free acidity values of all Egyptian honey samples ranged from 18.50 to 76.5 meq/kg and . The highest rate of free acidity was 48.5 in clover honey in Qena & Assiut, while the lowest rate was 18.5 in Qalubia (Table 2).

The values of lactone content in honey samples ranged from 5.0 – 45.0 mq./kg and the highest rate of lactone was 45.0 in clover honey in Minia, while the lowest rate was 5.0 in Qena & Assiut, (Table 2).

The values of total acidity honey samples ranged from 25.5 – 81.0 mq./kg and highest rate of total acidity was 81.0 in clover honey in Minia, while the lowest rate was 25.5 in Gharbia & Qalubia, (Table 2). The results shows clear differences between clover samples from different region .These results agreed particularly with Gomez, *et al* (1993) found that the free acidity of honey 25.34, lactones. 2.94 and total acidity 28.28 mq/kg . foldhazi *et al* (1996) showed that free acidity ranges 4.98 – 25.7, lacton 3.39 – 10.9 and total acidity between 8.38 – 31.3 mq/kg. Terrab *et al*, (2002) reported that free acidity ranged from 10.3 – 102, lacton acidity ranges 0.01 and 21.4, while total acidity ranges between 12.6 – 115 mq/kg (tharwat and Nafea (2006). Nafea *et al* (2009) found that the pH value ranged 3.3-4.2 , free acidity ranged 12.0-61.0 meq/kg , lacton ranged 18.5-225.0 meq/kg and total acidity ranged 1.5 – 12.0 meq/kg of different Libyan honey types .

Sugars

Honeys is primarily a carbohydrate product, and sugars may make up as much as 99% of the solids of honey, which are responsible for much of the physical nature of honey, its viscosity, hygroscopic, granulation and energy values (White 1957 and Crane, 1979). The fructose content (table, 2) ranged from 37.57% in Qalubia – 40.43% in Kafr- El Shekh. The glucose content ranged from 30.2% in Bani-Swief – 33.0 % in Qena .The sucrose content percentage ranged from 1.2% in Assiut – 6.03% in Bani-Swief . The maltose content of different regions of honey ranged between 3.5% in Gharbia – 8.0 % in Assiut. Nour (1988) reported that the values of sugars in clover honeys were, fructose 33.64-44.52% with mean of 39.83%, glucose -28.35-36.09% with mean value 32.56% sucrose 0.97-2.31% with mean of 1.65% and maltose 2.22-9.84% with mean value 6.97%. The values of sugar analysis obtained in investigation agreed particularly with those of El-Sherbiny *et al* (1980) and Hassan (1985). Nafea (2004) concluded that 36.9 – 41.0 % fructose , 28.3 – 34.2 % glucose , 1.1 – 4.17 % sucrose and 2.8 – 5.5 maltose of different honey types. Elsharawi *et al* (2009) found that fructose value of different Aswan honey types were ranged 38.0-40.0%, glucose 24.0-33.2% , sucrose 0.93-3.6 % and maltose 2.85-3.6% of different Libyan honey types **.** Nafea *et al* (2009) found that the fructose value 34.9-42.3% ,glucose 26.2-32.2%, sucrose 1.3-5.3% and maltose 5.0-11.0% of different Libyan honey types**.**

Table (1): Physical Properties of Egyptian Clover Honeys.

Region	Specific Gravity	Viscosity (Poise)	Color (O.D)	Granulation (G/W)	EC (ppm)	TSS %
Suez	1.4101	48.10	0.19	1.437	100.0	81.00
Dakahlia	1.4088	44.95	0.25	1.760	247.5	80.88
Gharbia	1.4108	41.50	0.22	1.714	160.0	81.13
Kafr-Elshekh	1.4177	47.03	0.26	1.680	156.7	80.75
Qalubia	1.4192	34.90	0.23	1.641	147.5	80.38
Sharqia	1.4116	49.64	0.16	1.756	114.0	81.20
Giza	1.4205	58.39	0.21	1.649	120.0	81.12
Bany-swief	1.4369	51.95	0.26	1.460	165.0	80.75
Minia	1.4548	93.05	0.29	1.473	110.0	82.75
Assiut	1.4101	48.10	0.14	1.631	180.0	81.00
Qena	1.4050	48.10	0.36	1.714	210.0	80.75
Mean	1.4100	46.93	0.23	1.630	155.5	81.00
F	14.33	3.830	5.023	13.102	2.652	3.804
LSD 5%	0.03735	40.59	0.120910	0.0689	66.60	1.3837

(EC) =Electrical conductivity
G/L = glucose/ water
O.D = optical density
TSS = Total soluble solids

Table (2):Chemical Composition of Egyptian Clover Honeys

Region	Moisture %	pH	Free Acidity mleq/ kg	Lactone Mleq/ kg	Total acidity mleq/ kg	Proline (ppm)	Frac-tose	Glucose	Sucrose	Maltose
Suez	19.00	3.80	23.00	7.50	30.50	23.55	38.50	30.50	4.50	5.50
Dakahlia	18.00	3.70	49.50	13.0	62.50	30.21	38.00	31.00	6.00	4.50
Gharbia	19.00	3.75	18.75	6.75	25.50	29.43	39.30	32.80	2.65	3.50
Kafr-Elshekh	19.30	3.72	20.80	7.00	38.40	30.65	40.43	31.40	2.28	4.38
qalubia	19.17	3.83	18.50	7.00	25.50	39.68	37.50	32.50	4.20	5.25
Sharqia	18.50	3.70	22.20	9.33	32.08	31.73	40.23	31.10	2.50	5.64
Giza	18.85	3.86	25.00	8.17	35.83	38.58	38.50	31.40	4.07	4.98
Bany-swief	18.83	3.83	37.17	12.8	43.00	34.43	37.57	30.20	6.03	5.50
Minia	17.50	4.15	76.50	45.0	81.00	32.73	39.40	31.65	3.25	6.35
Assiut	19.00	3.80	48.50	5.00	53.50	28.57	40.00	31.00	1.20	8.00
Qena	19.25	3.70	48.50	5.00	53.50	51.35	40.00	33.00	2.50	3.60
Mean	18.76	3.80	35.31	11.50	43.75	34.07	39.03	31.50	3.56	5.20
F	3.575	1.98	1.093	15.92	8.39	3.22	2.32	4.16	2.87	3.40
LSD 5%	1.75	0.36	85.43	8.28	17.9	12.71	1.65	1.99	2.07	1.78

Proline

The free proline content of the analyzed samples showed a wide variation of 23.55 – 51.35 mg/kg. and highest rate of proline was 51.35 in clover honey in Qena,while the lowest rate was 23.55 in Suez,(Table 2). Costa *et al.,* (1999) the content of proline is also used as an appropriate parameter for identifying when the honeys are-ripe or not. In accordance with previous work (Yon Der Ohe, .Dustmann. & Von Der Oht 1991) .

In my opinion it was suggested that the different factor affected the composition from different botanical origin and different region:
A, Effect of crop year.

B, Effect of honey storage
C, Effect of area production
D, Variation in beekeeping treatment

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"دراسات على بعض الخواص الطبيعية والكيميائية لعسل البرسيم في مصر"

إبراهيم سليمان عيسى [1]، عبد الحكم عبد اللطيف الصعيدى[1] ، إبراهيم عبد الرازق إبراهيم شحاته [1]و عمرو علي علي متولي[2]
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اجري هذا البحث لدراسة أهم الخصائص الطبيعية و الكيميائية لاعسال البرسيم في مصر وقد جمعت الاعسال من أحدى عشرة محافظه في جمهوريه مصر العربية (كفر الشيخ، الغربيه، السويس، الدقهليه، القليوبيه، الشرقيه، الجيزه، بني سويف، المنيا، أسيوط، قنا) .أجريت التحاليل المختلفة في معمل تحاليل منتجات نحل العسل بقسم بحوث النحل –معهد بحوث وقاية النباتات – مركز البحوث الزراعية.

وقد اسفرت هذه الدراسة عن النتائج التاليه :

اولا الخواص الطبيعية: وكان المدى الذى تتراوح فيه كل من هذه الخواص ومتواسطاتها الحسابيةعلى النحو التالى:

الكثافة النوعية(1.4548-1.4050) بمتوسط (1.41),اللزوجة34.90 - 3.05 poise

وكانت اعلى لزوجة فى عسل البرسيم بمحافظة المنيا واقلها لزوجة فى عسل برسيم محافظة القليوبية بمتوسط(46.93),اللون (0.14-0.36) بمتوسط (0.23)، التحبب (1.760-1.437) بمتوسط(1.63), وكانت اكثر الاعسال ميلا للتحبب هو عسل محافظة الدقهلية واقلها بمحافظة السويس، درجة التوصيل الكهربي(247.5-100.0ppm) بمتوسط(155.5)ppm ,المواد الصلبة الكلية الذائبة(80.38-82.75%) بمتوسط(81)%,.

ثانيا الصفات الكيميائية:وكان مدى النتائج المتحصل عليها كالأتي:

الرطوبة كانت 19.25 – 17.5 بمتوسط 18.76% ،درجة الحموضة(3.7-4.15) بمتوسط(3.8), الحموضة الحرة مجم/كجم(76.5-18.5) بمتوسط(35.31),اللاكتون(5.0-45.0) بمتوسط(11.5), الحموضة الكلية(0.81-25.5) بمتوسط(43.75).

وأوضحت نتائج قياس السكريات المختلفة النتائج الأتيه:

- الفركتوز(40.43-37.57%) بمتوسط (39.3)،الجلوكوز(33.0-30.2%) بمتوسط (31.5),السكروز(1.2-6.3%) بمتوسط (3.56%),المالتوز(8.0-3.5%) بمتوسط (5.2%).
- كما أوضحت النتائج أن المدى للحمض الأميني البر ولين (51.35-23.55مجم/كجم)بمتوسط (34.07) مجم/كجم.

قام بتحكيم البحث

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