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Some qualitative properties of different monofloral honeys

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Abstract

Viscosity values of pine honey samples were found the highest in Datça honey (11.762-5.300 Pas). Diastase value ranged from 13.900 to 7.250, and was found the highest in Dalyan sample and the lowest in Datça sample. HMF values of samples were found between 9.285 to 2.208 and found the highest in Dalaman and Dalyan samples and the lowest in Marmaris samples. Total phenolic substance content varied between 135.51 to 79.20 . It was found the highest in Muğla sample and the lowest in Yatağan sample. The amount of Calcium was found between 294.41 to 17.35, and was the highest in Ortaca and Datça samples while it was the lowest in Yatağan sample. Potassium values of pine honey samples ranged from 16159.20 to 12845.88, and the highest in Datça sample and the lowest in Ortaca sample. Ca, K, Na, P elements were determined major macroelements pine honeys.

Keywords: pine honey, harvest, locations, physical and chemical properties, minerals.

1. Introduction

Homopters called Basra (*Marchelina hellenica*) that live on plants leave a certain secretion on these plants. These secretions are collected by honeybees and exposed to a change in bodies of bees and converted to honey. Honey composition depends on the produced season and climate conditions [1]. Honey consists of carbohydrades, enzymes, water, organic acids, minerals, vitamins, proteins, aromatic and antioxidant substances [2]. Polyphenols, flavonoids and phenolic acids that are some components of honey are natural antioxidants that should be in our diet [3]. Pine honey is produced not from flower pollens of bees but from bees' using secretions of mediary insects; thus it's exceptional. It is found only in Turkey and Greece in the world. "Çam pamuklu" insects feed themselves by absorbing pine saps and defecate the rest as a sweet substance [4].

The aim of this study is to put forward some physical, chemical and nutritional features of pine honey samples collected from seven different districts of Muğla. The other aim of this study is to observe the difference between 1. cut and 2. cut honey which are the productions of the same bees of the same producer in two different times sequentially. The proportion of flower honey in 1. cut honey is higher than 2. cut honey.

2. Materials and Methods

2.1. Materials

In this study, honey samples were collected at the two harvest periods from seven different locations (Ortaca, Dalaman, Muğla, Datça, Dalyan, Marmaris, Yatağan) of Muğla province. Samples were added into glass jar and kept at the room temperature by analyses.

2.2. Determination of color

50g of homogenized honey sample was weighed and colour measurement was carried out in a glass beaker. In the research , colour CR 400 (Japan) model calorimeter was used and L* (100:white, 0:black), a* (+ : red ; - green) and b* (+: yellow ; -: blue) values were detected [5].

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2.3. Viscosity

50 g of honey sample was weighed and were soaked in water bath at 25°C for an hour. Viscosity of honey samples were measured with Vibro (SV–10) viscometer [6].

2.4. Free acidity

In order to determine free acidity of honey, 10g of honey was dissolved in 75ml of pure water and honey solution was titrated with %0.1N NaOH solution until pH value became 8.3 [4].

2.5. Ash

About 3 g of honey was weighed in ash crucibles and burned in ash stove at 900°C, and was weighed in precision balance and then ash contents of the samples were calculated (AOAC, 1995) [7].

2.6. Diastase Number

10 g honey was weighed, and rarefied with 100 ml pure water. Concentration of honey solution in 25 ml tubes in certain amounts was mixed with amylum solution and was kept in water bath at 38°C constant temperature for an hour. Amylum is hydrolized by the effect of diastase enzyme in honey. According to this principle, amylum which wasn't hydrolized after the hydrolysis process is processed with iodine solution and converted to a coloured complex. Tubes are examined with the eye starting from the number 1. The first tube on which blueness is observed is taken as the boundary. The diastase number of honey was recorded by reading the diastase number that corresponds to the former test tube (AOAC, 1995) [7].

2.7. Hidroxy Methyl Furfural (HMF)

After the HMF amount that was formed as a result of the fragmentation of fructose –a honey carbohydrate- by heating honey was stirred with 10 g of honey para toluidin and barbituric acid, the absorbance of the solution was measured at 550 nm as spectrophotometric. Present HMF amount in honey was calculated according to the value detected in the device.

2.8. Mineral Analyses

About 0.5 g of honey samples was put into burnig cup with 15 ml of pure NHO_3 and 2 ml H_2O_2 (% 30 w/v) The sample was incinerated in a MARS 5 microwave oven at 210 ˚C. Distilled deionized water and ultrahigh-purity commercial acids were used to prepare all reagents, standards, and samples. After digestion treatment, samples were filtrated through whatman No 42.

The filtrates were collected in 50 ml flasks and analysed by ICP-AES. The mineral contents of the samples were quantified against standard solutions of known concentrations which were analysed concurrently [8].

2.9. ICP-AES

Instrument: ICP-AES (Varian-Vista); RF Power: 0.7-1.5 kw (1.2-1.3 kw for Axial); Plasma gas flow rate (Ar): 10.5-15 L/min. (radial) 15“ (axial); Auxilary gas flow rate (Ar): 1.5“; Viewing height: 5-12 mm; Copy and reading time: 1-5 s (max.60 s); Copy time: 3 s (max. 100 s).

2.10. Total phenol

Total phenolic substance was determined by using the chemical of Folin-Ciacueltau. After weighing 5 g of honey samples, they were rarefied with 50ml of pure water. 100µl was taken from the rarefied sample and put in a different tube. Then 1ml of %10 percent Folin–Ciacueltau was added and mixed for two minutes. At the end of 20 minutes, total phenolic substance was determined as 750 nm wavelength in spectrophotometer. Gallic acid was used (0-200 mg/ml) as the Standard solution [9].

2.11. Statistical Analyses

The research was arranged according to 7 x 2 x 3 factorial testing model (7 honey x 2 harvest x 3 replication). Results of the research were evaluated by using Tarist statistics program and averages of main variance sources that were found important were compared by applying Duncan multiple comparison test [10].

3. Results and Discussion

3.1. Some physicaland chemical properties of honeys

According to the variance analysis results, while the change in cutting time effects viscosity, HMF, ash, total phenolic substance, electrical conductivity and free acidity at $p < 0.05$ level, it has got no effect on diastase, brix and b values (Table 1). The effect of different cutting time and difference of location on viscosity, diastase, HMF, ash, brix, total phenolic substance, electrical conductivity and free acidity was analysed with Duncan multiple comparison test. In different cutting times, while there is no difference in diastase, HMF, brix and total phenolic substance statistically, it was observed that the amount of ash and electrical conductivity increased dramatically in 2. cutting. It was observed that during the conversion of 1. Cut honey to 2. Cut honey that has higher proportion of pine honey, the proportion of acidity and viscosity decreased. When the effect of difference of location on properties of honey samples was studied (Table 2); viscosity values were found the highest in Datça honey (11.762 – 5.300) and the lowest in Muğla honey. Diastase values changed between 13.900 to 7.250 and was found the highest in Dalyan sample and the lowest in Datça sample. HMF values of samples were found between 9.285 to 2.208, and were found the highest in Dalaman and Dalyan samples and the lowest in Marmaris samples. It was found that difference of location causes no change in degree of brix statistically. Total phenolic substance content ranged from 135.513 to 79.202 and it was found the highest in Muğla sample and the lowest in Yatağan sample. Electrical conductivity changed between 14.967 to 6.860 and was found the highest in Muğla sample and the lowest in Dalyan sample. Free acidity of honeys changed between 0.482 to 0.277 and was found the highest in Dalyan sample and the lowest in Ortaca, Muğla, Marmaris and Yatağan samples.

When colours of honey samples were studied, it was found that L value varied between 68.205 and 54.908 and reached the top level in Dalaman sample, A value was between 6.492 and 0.830 and was found the highest in Dalyan sample and b value was between 41.955 and 32.279 and was found the highest in Dalyan sample.

Although the difference of location statistically has no effect on brix degree, it was observed that brix degree changed in accordance with viscosity and that in Datça honey in which viscosity was at maximum level, brix was at max level too.

3.2. Mineral contents of honeys

According to the variance analysis results, the change in cutting time effected K, Mn amounts at $p < 0.01$ level and effected Ca, P and Pb amounts at $p < 0.05$ level but it was ineffective on Al , B , Cr , Cu , Na , Se , Zn amounts (Table 3). The effect of different cutting time and difference of location on Al, Ca, B, Cr, Cu, K, Mn, Na, P, Pb, Se, Zn minerals was analysed with Duncan multiple comparison test. While statistically there was no difference in Al , Ca, B, Cr, Cu, K, Na, P, Pb, Se and Zn rates, it was observed that Mn rate decreased in 2. Cutting.

When the effect of difference of location on honey samples was examined, the amount of Al was found between 12.495 and 2.495 and was the highest in Dalyan honey, and the lowest in Ortaca, Dalaman and Yatağan honey (Table 4). The amount of Calcium changed between 294.413 to 17.353 mg/kg and was the highest in Ortaca and Datça samples while it was the lowest in Yatağan sample. Cr content changed between 1.193 to 0.200 ppm, and it was the highest in Ortaca sample and the lowest in Muğla sample. Cu contents of samples changed between 3.070 to 0.063 ppm and the highest in Dalyan sample and the lowest in Dalaman sample; Potassium contents of pine honeys were found between 16159.200 to 12845.887 mg/kg, and the highest in Datça sample and the lowest in Ortaca sample; Mn was found between 13.228 to 0.4 ppm and the highest in Dalyan and the lowest in Ortaca, Dalaman and Yatağan samples. Na was found between 649.132 and 186.828 mg/kg and the highest in Ortaca and the lowest in Muğla sample; P was found between 802.360 to 546.803 mg/kg and the highest in Datça, the lowest in Marmaris sample. Among the samples, there was no difference in terms of Pb amount. Se was found between 5.480 to 1.068, and the highest in Datça sample and the lowest in Yatağan sample; Zn changed between 23.163 to 0.958, and the highest in Marmaris and the lowest in Muğla honey.

Zappala, Fallico, Arena, & Verzera [11] reported that the HMF measured by white method, were 27.7 and 31.3 mg/Kg of honey for eucalyptus 1, 6.9 and 7.3 mg/Kg of honey for eucalyptus 2, using the suggested formula and the external calibration,

Table 1. Effect of harvest time on some physical and chemical properties of pine honeys

Harvest time	Viscosity(Pas)	Diastaz Number	HMF(mg/kg)	Ash (%)	°Brix	Total phenol (mg/100g)	Electric conductivity(µs/cm)	Free acidity (%)	L	a	b
1	8.575a[a]	10.300a	5.905a	0.558b	80.870a	94.106a	9.213b	0.343a	64.633a	0.212a	36.326a
2	7.336b	10.132a	5.020a	0.675a	80.341a	110.386a	12.031a	0.309b	60.956a	1.780a	36.857a

[a] Means within colomns bearing th same letters supercripts are not significantly different.

Table 2. Some physical and chemical properties of pine honeys

Locasions	Viscosity(Pas)	Diastaz number	HMF(mg/kg)	Ash (%)	°Brixs	Total phenol(mg/kg)	Electric conductivity (µs/cm)	Free acids (%)	L	a	b
Ortaca	8.523 d[b]	10.313bc	4.898b	0.442c	80.833a	110.525abc	9.355cd	0.282c	63.419ab	-0.680c	32.279c
Dalaman	6.572e	9.450c	9.285a	0.550c	80.267a	80.847de	12.650b	0.323b	68.205a	-0.332c	39.066ab
Muğla	4.782g	10.200bc	4.903b	0.563bc	79.433a	135.513a	14.967a	0.285c	63.587ab	2.690ab	33.073c
Datça	11.762a	7.250d	4.905b	0.733a	81.667a	105.160bcd	6.860e	0.338b	57.692bc	-0.197bc	33.697c
Dalyan	9.690b	13.900a	8.002a	0.765a	80.922a	118.692ab	8.600d	0.482a	54.908c	6.492a	41.955a
Marmaris	5.300f	9.450c	2.208c	0.565bc	79.717a	85.783cde	12.267b	0.293c	67.717a	-0.830c	40.708a
Yatağan	9.060c	10.950b	4.033b	0.695ab	81.602a	79,202e	9.867c	0.277c	64.035ab	-0.173bc	35.363bc

[b] Means within columns bearing the same letters supercripts are not significantly different.

Table 3. Effect of harvesting times on mineral contents of pine honeys

Harvest times	Al	Ca	B	Cr	Cu	K	Mn	Na	P	Pb	Se	Zn
1	4.501a[c]	190.284a	118.456a	0.582a	0.779a	13065.564a	4.994a	372.059a	632.706a	2.421a	3.631a	7.393a
2	4.789a	163.841a	113.741a	0.464a	0.888a	15457.087a	3.142b	363.551a	686.877a	1.553a	4.192a	9.875a

[c]Means within colomns bearing th same letters supercripts are not significantly different..

Table 4. Mineral contentsof pine honeys

Locations	Al	Ca	B	Cr	Cu	K	Mn	Na	P	Pb	Se	Zn
Ortaca	2.433c[d]	281.610a	151.030a	1.193a	0.123bc	12845.887b	0.000c	649.132a	604.600cd	2.470a	3.943ab	9.747b
Dalaman	2.495c	209.925b	111.688bc	0.505bc	0.063c	13570.700ab	0.000c	456.398ab	564.875cd	1.743a	3.985ab	9.892b
Muğla	4.920b	144.743c	110.263bc	0.200c	1.118b	14499.097ab	7.255b	186.828d	669.458abc	1.365a	5.445a	0.958d
Datça	5.100b	294.413a	127.663ab	0.380bc	0.695bc	16159.200a	7.593b	344.905b	802.360a	2.470a	5.480a	7.755bc
Dalyan	12.495a	180.488bc	119.790ab	0.653ab	3.070a	14153.763ab	13.228a	323.700bc	772.147ab	2.233a	4.755a	3.265cd
Marmaris	2.728bc	108.910d	105.263bc	0.388bc	0.170bc	14508.220ab	0.400c	418.290b	546.803d	2.242a	2.708ab	23.163a
Yatağan	2.345c	17.353e	86.995c	0.345bc	0.595bc	14092.410ab	0.000c	195.383cd	658.300bc	1.385a	1.068b	5.658bcd

[d]Means within colomns bearing th same letters supercripts are not significantly different.

respectively. The HMF measured by winkles method were 52.4 and 45.4 mg/Kg of oney for eucalyptus 1, 11.5 and 9.7 mg/Kg of honey for eucalyptus 2. Rashed & Soltan [12] determined trace elements (Co, Ca, F, Fe, I, Mn, Ni, Sr and Zn) and major elements (Cl, N, K and Mg as well as toxic elements Cd and Pb) in different types of bee honey which include non-floral honey with artificial feeding (Syrup-feed honey), and mono-floral honeys (sesame honey, orange honey and clover honey). Orange honey contained the lowest element concentrations. Clove honey had the lowest toxic element Cd and Pb concentrations (0.01 and 4.2 µg/g, respectively) while sesame honey contained the highest levels of Cd and F (0.5 and 12.5 µg/g), respectively. Some researchers reported K as the most abundan element in honey produced in Galicia (Northwest Spain) with an average content of 1572 mg/Kg, while the mean contents (mg/Kg) of the other elements were Na 138, Ca 102, Mg 106, Cu 1.11, Fe 5.12, Mn 402, P 110, Cl 245, Si).16 and S 6.85 [13]. Ahmed et al [14] determined some physico-chemical properties of selected Indian honeys. Total solids, ash contents, pH and Specific gravity valus of these oils were found between 76% to 88%, 0.08% to 0.39%, 3.8% to 5.0% and 1.33 to 1.56, respectively. At the some time, color variations of Indian honey samples changed between 40.96 to 53.53 for color L value, 0.10 to 5.86 for color a value and 10.62 to 22.99 for color b value [14].

Küçük, Kolaylı, Karaoğlu, Uluoy, Baltacı, & Candan [15] measured 17.0%, 19.7 and 19.0% moisture; 0.20, 0.50 and 0.24% ash; 29.4, 36.7 and 33.6 meq/Kg total acidity; 19.2, 28.6 and 24.1 mg/Kg HMF and 17.9, 17.7 and 23.0 diastase activity in Hetrofloral, Chestnut and Rhododendron honeys, respectively. All three samples showed on HMF level lower than the upper limit set (40 mg/Kg). The same researchers determined 73-163 g/Kg Na, 500-3818 mg/Kg K, 160-900 mg/Kg Ca, 1.72-2.64 mg/Kg Fe, 0.09-0.42 mg/Kg Cu, 0.54-0.68 mg/Kg Zn and 0.59-9.69 mg/Kg Mn of thehoney samples. Liviu A. et al. [16] reported that the ash content changed between 0.03% to 1.23% in several honey samples collected from different regions of Romania. The water content of sample were found at the levels between 15.40% to 20.0%. The contents of trace elements in honey samples were in the range of 0.23-241 µg/g, 0.32-4.56 µg/g, 1.1-12.7 µg/g, 1.8-10.29 µg/g,8.4-105.8 µg/Kg, 2.6-29.9 µg/Kg, 2.4-37.9 µg/Kg, 0.9-17.9 µg/Kg, 83-325 µg/Kg and 38-113 mg/Kg for Cu, Mn, Zn, Fe, Pb, Ni, Cr, Cd, Al and Se [17]. Saxena, Gautam, & Sharma [18] determined 17.2-21.6 % moisture, 1140-8500 viscosity (cP), 76.2-80.4 orix, 0.03-0.43% ash, 0.33-0.94 mS/cm EC, 49-98 mg GAE/100 g total phenol and 3.7-4.4 pH in some commercial brands of Indian honeys. Silici, Sagdıç, & Ekici [19] reported that total phenolic content of honeys ranged frm 0.24 to 141.83 mg GAE/100 g honey. Total contents of selected Czech honeys, were found between 83.60 to 242.52 mg GA eq/Kg [20]. The qualities of 15 red pine honey samples from different parts of the Muğla province in Turkey were evaluated. Brix, pH, moisture, ash, electrical conductivity, free acidity, diastase activity (Gothe degrees) and HMF values of pine honey samples were determined between 81.4 to 83.4, 4.26 to 5.27, 14.84 to 16.87, 0.24 to 0.60%, 878 to 1463 µS/cm, 6.23 to 15.62 mEq/Kg, 7.17 to 22.71 and 1.54 to 23.42 mg/Kg, respectively [4].

4. Conclusion

In this study, from the two sequential harvest period products from seven distinct regions , 1. Cutting and 2. Cutting pine honey samples were taken and some physical and chemical properties of these samples, mineral contents and phenolic substance contents were determined. As to physical properties, it was observed that in terms of colour, they are darker in comparison to flower honey. HMF values measured in the samples were quite low. It was concluded that the storage conditions are appropriate and no heat treatment was carried out. It was also seen that phenolic substance contents are high. Moreover, Ca, K , Na , P elements were presented in pine honey as macrominerals and it was seen that it contained trace metals that were necessary for nutrition.

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Compliance with Ethics Requirements

Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

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