Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2016, 8(8):1199-1202

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

The effect of microhabitat on qualitative characteristics of the wild jujube *Ziziphus lotus* (L.) Desf. Libyan honey type

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ABSTRACT

Two samples of Ziziphus Libyan honey were collected from different locations and analyzed for their qualitative characteristics. The results of color analysis using colorimeter and pfand scale showed different degrees of color which reflect the plant resource components. The results reflected also that the number of pollen grains was differed among the honey samples according to plant resource region. Mellissoplaynology investigation revealed high degree of purity because of the pollen percentage which exists in the honey samples. The pollen grain content was more than 45% in all samples. While the lower amount of pollens of other species was found with percentage of 3.11%.

Keywords: Mellissoplaynology; Libyan honey; Libyan flora; Beekeeping industry.

INTRODUCTION

Historically, the relationship between the bees and human beings is very old when man started using bees and their products as source of food and medication. Beekeeping has an ecological role while it contributes indirectly to the sustainability of plant resources through the pollination process.

In Libya, the most workers in beekeeping and their production are exist in the coastal regions of the country(northern part) because of abundance and distribution of plant species in this area. This occurs according to the amounts of rainfalls especially in EL-Gabal EL-Akhdar area, which receive around 700 ml/year, while most of the country(about 90%) has desert climatic conditions. These zones are characterized by low and restricted precipitation per year. And according to Köppen climate classification, one of major types of climate when describing the arid and semi-arid zone is the Mediterranean climate [7]. Libyan flora consists of more than 1800 species with different life forms [11] but a very little number of these species such as *Ziziphus lotus* L. are forage by bees and use in honey production.

The wild jujube *Ziziphus lotus* (L.) Desf., Commonly called "Sidar", is a species found in many habitats in arid and semi arid regions of the Mediterranean basin like Spain, Morocco, Algeria, Tunisia and Libya [12]. This plant species classified as threatened and restricted-range taxon in Libya [4], because its distribution is very rare and it exist in the sides of valleys (Wadi), where the moisture is mostly available. Morphologically, the shrub of *Ziziphus lotus* is very dense and very thorny with edible fruits. It blooms in the spring, in March and April. The flowers are small, arranged in racemes. They are actinomorphic, bisexual, green-yellowish [13], and secrete large amounts of nectar and are visited by numerous insects, especially honeybees.

Purity and quality of bees honey is very important in commercial and folk medication, therefore, using specific methods to determine these characteristics is very important. Melissopalynology, which identifying as a kind of analysis evaluating the respective percentages of pollens that occurred in honey is one of the earliest and common methods to determine the quality degree [8] and a number of studies reported that[1, 3, 6]. In addition, the honey

color, which related to the plant resource and its chemical composition that affect with its habitat conditions like rainfalls and soil characteristics [2, 5].

In this study, we assayed two samples of ziziphus honey collected from two locations in the east part of Libya to find out the quality characteristics of the same honey type. And to what extant those characteristics affected by forage plant resource habitat.

EXPERIMENTAL SECTION

Honey samples collection: two samples of zyziphus honey were collected from two different locations (Table 1). The first sample was collected from Qaser Libya which far around160 km of the eastern borders of Benghazi city at 32°38' N. 21°24' E, while the second sample was collected from the south part of Elabiar which far around 60 km of the south eastern of Benghazi city, and located at altitudes of 32°11'20"N. and 20°35'48" E.

Table 1. The data of ziziphus honey samples which collected from two different places in east part of Libya

Sample No.	Place of collection	Production date	PH
1	Qasar Libya	2015	3.88
2	Wadi elaagor/Abiar	2015	4.34

Color characteristics: to determine transparency, 5 g of each honey sample were dissolved in 25 ml distilled water. The samples were centrifuged for 5 min at 35000 rpm and the absorption spectrum was determine using colorimeter(Hana,Germany) at different wave lengths. On the other hand, Pfand scale was used to find out the classification of honey color according to USDA.

Preparation of honey samples for mellisopalynology: Honey samples were prepared followed the standardized method which described previously by different authors [1, 3, 8, 11]. Briefly, 10 g of homogenized honey were dissolved in 20 ml of distilled water and centrifuged for 10 min at 1000 g at ca. 25000 rpm. To completely dissolve the remaining sugar crystals, the decanted sediment were washing with 10 ml of distilled water. After another centrifugation, the sediment were suspending in 5 ml of 1:1 glycerin: distilled water and then centrifuged again, decanted, and mounted with glycerin jelly on microscope slides which sealed with paraffin.

Microscopic analysis: The analysis of the pollen slides was carrying out with an optical microscope at X400, in order to make sound identification of the pollen types. The amounts and percentage of each pollen type were determined.

RESULTS AND DISCUSSION

The results showed that the samples which collected from different locations were differed in their colors (Figure 1). The color of the samples of *Zyziphus lotus* honey was ranged from extra light amber to light amber according to pfand scale of USAD (Figure 2). Using colorimetric method at different wave lengths revealed the differences in honey transparency(T%) and absorption(Abs). The absorption spectrum was decreased by increasing the wave length in all samples (Table 2). The transparency of honey samples at 635 nm was 99.76 and 99.72, while the Absorption values were 0.24, and 0.275 for the samples 1 and 2, respectively (Figure 3).

Table 2. transparency and absorption values of the ziziphus honey samples at different wave lengths using colorimeter method

Wave length/nm	sample No.			
	1		2	
	Abs	T%	Abs	T%
440	0.59	99.41	1.02	98.98
470	0.53	99.47	0.84	99.16
490	0.44	99.56	0.66	99.34
520	0.38	99.62	0.52	99.48
550	0.33	99.67	0.45	99.55
580	0.3	99.7	0.36	99.64
590	0.25	99.75	0.29	99.71
635	0.24	99.76	0.275	99.725
680	0.23	99.77	0.26	99.74

Figure 1. The color of *Zyziphus lotus* honey which collected from different locations from east part of Libya. Note the grading of color (light to dark) from left to right according to distribution and habitat of *Zyziphus lotus* plant species

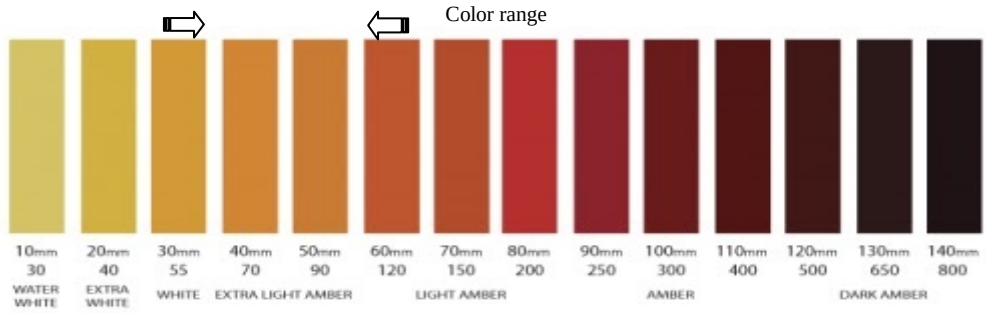

Figure 2. The color of *Zyziphus lotus* honey which ranged from 40 mm (Extra light amber) to 150 mm (light amber) according to pfand scale of USAD. The color reflects the effect of location and environmental factors especially rain falls on plant resource and subsequently, the honey color

Mellissopalynology investigation showed that the samples had a number of variations in pollen content between very frequent, frequent and isolated, but not rare (Table 3). The samples reflected very high purity because of the content of pollens of *Zyziphus lotus* species which exist in the samples (very frequent) and they were 55%, 69.20% and 57.49%, respectively.

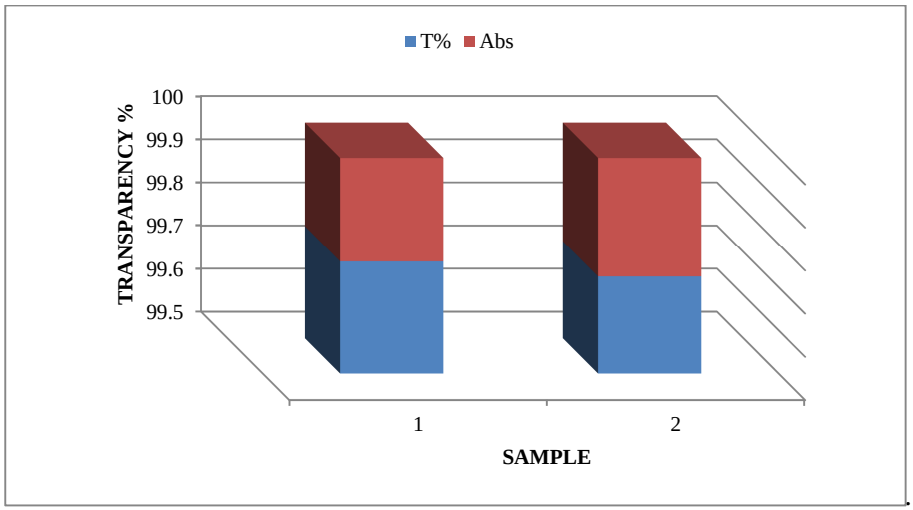

Figure 3, the transparency percentage of ziziphus Libyan honey at wave length of 635 nm using colorimeter method
Note the absorption values according to the color degree of the sample.

Table 3. The pollens content according to the number of pollens type in honey samples
The high percentage of very frequent class in all samples, while other types appeared in different amounts

Sample No	1	2
very frequent	69.20%	57.49%
Frequent	12.10%	17.45%
Isolated	10.38%	13.75%
	5.19%	7.18%
	3.11%	4.10%
Total	578	487

Honey color is one of the most important factors to be considered as a quality parameter of honey [5, 10]. The color and flavor of honeys differ depending on the nectar source (the forage plant) visited by the honey bees. From the results, even though the samples were for the same plant source but the effect of plant habitat was clear and appeared as reflection of honey color. The jujube plants which distributed in the north part of EL-Gabal EL-Akhdar, produced honey with a lighter color. While the dark sample was collected from plant location number 2.

Ponits *et al.* (2013) reported that honey from the same origin can have different color intensities. This grading in color might because of precipitation which fall in amounts differed from plant microhabitat to other and subsequently, increasing or decreasing the phenolic components that responsible of the color intensity[10]. Ferreira *et al.* (2009) demonstrated that dark honeys were richer in phenolics and had a higher antioxidant activity. Therefore, using darker honey widely in Libyan folk medication tend to its color can be accepted.

Melissopalynology has been extensively used to determine the purity, geographical and floral origins of honey. It is also used to assess correlations of climatic parameters such as rainfall and temperature important in the context of external factors influencing pollinators and pollination networks.[3, 9]. From the results, it is very clear that the pollen content had a number of classes (Table 3). Through melissopalynology, the most vegetation in the area is completely affected by the climatic factors especially rainfalls and the reason for this lies in the abundance of microclimates created by the orography of the land. Therefore, a few number of pollen classes of trees or shrubs were appeared as pollen spectrum.

It should also be mentioned that the very dominant pollens of *zyziphus lotus* in all samples were more than 42% (Table 3). In addition, other classes of pollens were in different percentages but still in levels of ICB [3, 6, 8]. This pointed to the high purity of the samples even though they were collected from different locations and reflected the vegetation cover in the area which dependent on rainfalls and mostly consists of annuals.

Acknowledgments
Our thanks go to the soul of Akram El wasiia, for his help and support for his wife Nisrin during her study. And also to Mr. Ali El ammari for his help to get the honey samples and all collected information.

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