MORPHOLOGICAL CHARACTERS OF HONEY BEE, *APIS MELLIFERA* L., POPULATION IN EL-BEHEIRA GOVERNORATE

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ABSTRACT

Morphological characters of honey bee, *Apis mellifera* L., workers collected from 48 colonies representing 6 different districts (Damanhour, El-Dalangat, El-Mahmoudia, Etay-El-Baroud, Hosh Esa and Kafer EL-Dawar) were studied through two years (2006 and 2007) to characterize honey bee population at El-Beheira Governorate. Fifteen morphological characters were selected. All measurements were made using Scan Photo technique. Statistical analysis revealed that there were significant differences among locations ($P < 0.05$) in all studied morphological characters during 2006, except for basitarsus width (BW). On the other hand, during 2007 there were significant differences among locations ($P < 0.05$), except five characters: forewing length (FWL), hind wing length (HWL), Distance D (DD) of forewing, hind leg femur length (FL) and hind leg basitarsus length (BL) were insignificant. The obtained results through the two years in all districts showed that tongue length (Ton L) means ranged from 5.24 to 6.05 mm, FWL means ranged from 8.65 to 8.86 mm, forewing width (FWW) means ranged from 2.88 to 3.03 mm, HWL means ranged from 6.04 to 6.18 mm and hind wing width (HWW) means ranged from 1.67

to 1.85 mm. The highest mean values of Cubital index (CI) and number of hooks (NH) were found to be 3.38 and 21.15, while the lowest mean values were 2.45 and 19.41, respectively. The highest means of Distance C (DC) and DD of forewing were found to be 0.83 and 1.91 mm, while the lowest ones were 0.79 and 1.82 mm, in respect. The highest mean of FL was found to be 2.29 mm, while the lowest one was 2.21 mm. The highest mean of hind leg tibia length (TL) was found to be 2.91 mm, while the lowest one was 2.78 mm. On the other hand, the highest and lowest means of BL were 2.18 and 2.07 mm, while the highest and lowest means of hind leg basitarsus width (BW) were 1.12 and 1.07 mm, respectively.

INTRODUCTION

Beekeeping in Egypt is extremely ancient, where honey bee, *Apis mellifera*, was kept during the time of the pharaohs, at least 5000 years ago. The *A. m. lamarckii* is well adapted to the local conditions and pests of the region. It was spread throughout Egypt including El-Beheira Governorate. Also, it is considered by some beekeepers to exhibit high levels of defensive behavior. Several honey bee breeding schemes have been implemented to improve the performance of domestic honey bees (Moritz, 2004). The Italian subspecies *A. m. ligustica* has shown to provide economical advantages to commercial beekeeping for its productivity (Dall'Olio *et al.*, 2004). Therefore *A. m. ligustica* queen bees have been imported. Also, a large population of *A. m. carnica* was imported over 30 years period and maintained in Egypt (Kamel *et al.,* 2003). Also, other races were imported to improve honey production and other economic characters in Egypt

(Page *et al.,* 1981). Nowadays, the Egyptian geographic honey bee race, *A. m. lamarkii* is being bred in a limit region of Assiout in Upper Egypt. By the time, honey bees in other regions of Egypt have gained some morphological, physiological and behavioral characters from different genetic resources.

The discrimination among honey bee subspecies is important for beekeeping and preserving honey bee biodiversity. Morphometry is a very powerful tool for the identification of bee species and subspecies (Francoy *et al.*, 2006). Morphometric studies have provided a large amount of information on the structure of *Apis mellifera* L. species (Garnery *et al.,* 2004). Daly *et al.* (1982) began to use digital measurements to investigate the morphometrics of honey bees, significantly reducing the time necessary for measuring, storing and analyzing the data. Moreover, several works with *A. mellifera* involving morphological characters showed that there is a strong influence of the environmental in the morphology of the same ones (Eischen *et al.,*1982; Milne and Pries, 1984; Milne *et al.,*1986). Beekeeping practices such as migratory beekeeping might induce high levels of introgression within populations (Drazic *et al.,* 2004; Rortais *et al.,* 2004). Also, the introduction of honey bee subspecies into different geographic areas by beekeepers has produced subspecies admixtures in many parts of the world (Arias *et al.,* 2006). Migratory beekeeping, importation and illegal introduction of queens from different unknown genetic resources are usually practiced in most areas of El-Beheira Governorate. Therefore, this study was conducted to investigate the morphological characteristics of honey bee samples from different locations of El-Beheira Governorate.

MATERIAL AND METHODS

Morphological characters of honey bee workers from six districts at El-Beheira Governorate were measured for two successive years (2006 and 2007). These districts were Damanhour (Damanhour city),

El-Dalangat (Dalangat city), El-Mahmoudia (Fesha village), Etay-El-Baroud (Etay-El-Baroud city), Hosh Esa (El-Kom El-Akhder village), and Kafer EL-Dawar (Kafer El-Dawar city).

Sample collection

Honey bee workers were collected from eight colonies chosen randomly from each district during autumn seasons (September to November) of 2006 and 2007. Each colony was represented by 15 honey bee workers according to Ruttner *et al*. (2000), Sheppard and Meixner (2003) and Meixner *et al*. (2007). Samples were collected directly from brood comb according to Padilla *et al*. (1992) by shaking bees in a jar. Total of 120 honey bee workers were collected from each district with total number of 720 honey bee workers for each year.

Preparing of samples and measuring of morphological characters

Collected honey bee workers were killed in a deep freezer. Workers were dissected using a forceps to separate body parts (tongue, right forewing, right hind wing, and right hind leg). Then, fifteen morphological characters were selected: tongue length (Ton L); forewing length (FWL) and width (FWW); Cubital A (CA) and Cubital B (CB) lengths (Fig.1); Cubital index (CI); Distance C (DC) and Distance D (DD) of forewing (Fig. 2); hind wing length (HWL) and width (HWW); number of hooks (NH); hind leg femur (FL) and tibia (TL) lengths; and hind leg basitarsus length (BL) and width (BW)]. All measurements were made using Scan Photo technique (Abo Shaara, 2009). Characterization of each district was obtained by calculating the average of data of the two years 2006 and 2007 for each district.

Statistical analysis

The experimental design was the Randomized Complete Block Design (RCBD). The data of morphological characters were statistically analyzed by analysis of variance and means were compared using the Least Significant Difference test with the aid of the SAS program (SAS Institute, 1999).
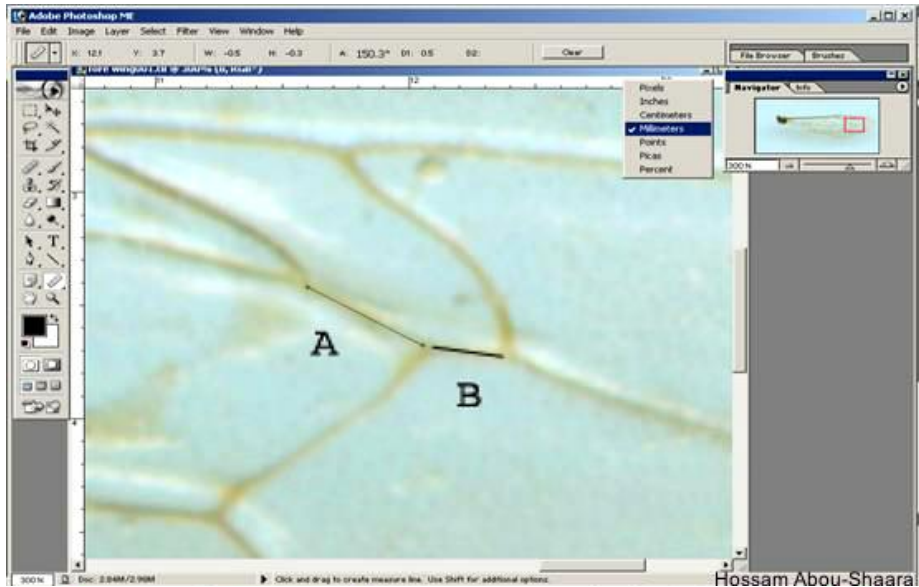
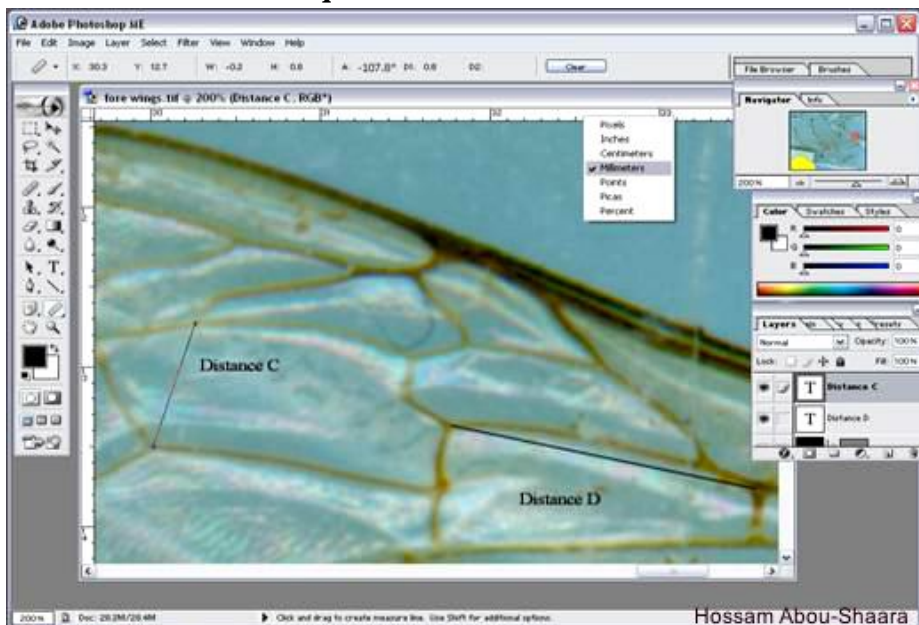**Fig.1: Measuring of Cubital A and Cubital B using Scan Photo technique to calculate Cubital index**

Fig. 2: Measuring of Distance C and Distance D of forewing using Scan Photo technique.

RESULTS AND DISCUSSION

1. Morphological characters of honey bee workers from different districts at El- Beheira Governorate.

Data in **Table 1** illustrate the mean values of 15 morphological characters of honey bee workers from six districts at El-Beheira Governorate during 2006. The data indicated that there were differences, in measurements of all morphological characters of honey bee workers, among districts. Ton L means ranged from 5.24 mm (El-Mahmoudia) to 5.79 mm (Kafr El-Dawar). FWL means ranged from 8.62 mm (El-Dalangat) to 8.86 mm (Damanhour), while FWW means ranged from 2.92 mm (El-Dalangat) to 3.03 mm (El-Mahmoudia). HWL means ranged from 6.05 mm (El-Dalangat) to 6.18 mm (Damanhour), while HWW means ranged from 1.71 mm (El-Dalangat) to 1.85 mm (Hosh Esa). CA means ranged from 0.50 mm (Damanhour and Hosh Esa) to 0.53 mm (Etay El-Baroud), while CB means ranged from 0.15 mm (El-Dalangat) to 0.20 mm (Etay El-Baroud). CI means ranged from 2.54 (Etay El-Baroud) to 3.79 (El-Dalangat). DC means ranged from 0.79 mm (El-Mahmoudia) to 0.83 mm (El-Dalangat and Kafr El-Dawar), while DD means ranged from 1.85 mm (Damanhour) to 1.91 mm (Etay El-Baroud). NH means ranged from 19.41 (El-Dalangat) to 20.85 (Damanhour). FL means ranged from 2.22 mm (El-Dalangat and Kafr El-Dawar) to 2.29 mm (El-Mahmoudia), while TL means ranged from 2.78 mm (El-Dalangat) to 2.91 mm (El-Mahmoudia). BL means ranged from 2.07 mm (El-Dalangat and Kafr El-Dawar) to 2.18 mm (El-Mahmoudia), while BW means ranged from 1.09 mm (Damanhour) to 1.12 mm (El-Dalangat and Kafr El-Dawar). The analysis of variance (ANOVA) revealed that, except for BW, there were significant differences among locations ($P< 0.05$) in all studied morphological characters.

Moreover, there were differences, in measurements of all studied morphological characters of honey bee workers, among studied districts during 2007 (as shown in **Table 2**). Ton L means ranged from

5.92 mm (Hosh Esa) to 6.05 mm (Damanhour). FWL means ranged from 8.71 mm (Damanhour) to 8.82 mm (Etay El-Baroud), while FWW means ranged from 2.88 mm (El-Mahmoudia) to 3.03 mm (Kafer El-Dawar). HWL means ranged from 6.04 mm (Kafer El-Dawar) to 6.16 mm (Etay El-Baroud), while HWW means ranged from 1.67 mm (Etay El-Baroud) to 1.80 mm (Kafer El-Dawar). CA means ranged from 0.47 mm (Damanhour) to 0.53 mm (Etay El-Baroud and El-Mahmoudia), while CB means ranged from 0.15 mm (Damanhour) to 0.21 mm (El-Dalangat). CI means ranged from 2.45 (El-Dalangat) to 3.19 (Damanhour). DC means ranged from 0.80 mm (Etay El-Baroud) to 0.83 mm (El-Mahmoudia), while DD means ranged from 1.82 mm (Hosh Esa) to 1.91 mm (El-Mahmoudia). NH means ranged from 20.12 (Etay El-Baroud) to 21.15 (Damanhour). FL means ranged from 2.21 mm (El-Dalangat) to 2.28 mm (Kafer El-Dawar), while TL means ranged from 2.79 mm (Damanhour and Etay El-Baroud) to 2.85 mm (Hosh Esa). BL means ranged from 2.07 mm (Damanhour) to 2.14 mm (El-Mahmoudia and Etay El-Baroud), while BW means ranged from 1.07 mm (Damanhour) to 1.12 mm (El-Mahmoudia). Statistical analysis revealed that there were significant differences among locations ($P < 0.05$) in all studied morphological characters except in five characters: FWL, HWL, DD, FL and BL which found to be insignificant.

The overall means of morphological characters of honey bee workers showed variations between the two years of the study (as shown in **Tables 1** and **2**): some characters increased in 2007 while the others decreased. Also, the variations between locations in 2006 (**Table 1**) were greater than those of 2007 (**Table 2**). One insignificant difference (BW) in 2006 vs. five insignificant differences (FWL HWL, DD, FL and BL) in 2007. These results may be attributed to the beekeeping activities like requeening. Our results were in agreement with the findings of Sirali *et al.* (2003) who found significant differences for Ton L and FWL; Kandemir *et al.* (2005) who found significant differences for FWL; Arias *et al.* (2006) who found

significant differences among locations for FWW, CA, CB, and NH; Alburaki and Alburaki (2008) who found significant differences for CI; and Padilla *et al*. (1992) who found significant differences between districts for FL and TL. On the contrary, Kandemir *et al*. (2000) found no significant differences for CA, CB and TL. Also, Alburaki and Alburaki (2008) found no significance differences in Ton L between samples obtained from two localities in Syria. These results may be attributed to the variations in the environment among studied districts. Several works on *Apis mellifera* involving morphological characters showed that there is strong influence of environment in the morphology of the honey bee workers (Eischen *et al*., 1982; Milne & Pries, 1984; and Milne *et al*., 1986). Such differences of honey bee workers from different districts may be attributed to the introduction of some honey bee queens belong to different races (principally Italian and Carniolan) to improve the characteristics of the native honeybee (*A. m. lamarckii*). The different resources of honey bee queens contributed in the different characters of nowadays honey bee existing in studied locations. The findings of Radloff *et al*. (2003) confirmed this explanation as they found high intercolonial heterogeneity for Assiut bees. On the contrary, Bienefeld *et al*. (1996) measured the degree of hybridization of *A.m.meda* in Iran and didn't find any influence of foreign races although the importation of many foreign queens. Because queen bees find and mate with drones from very distant locations, genes from wild populations and domestic strains are constantly mixing (Moritz, 2004). The separation of breeding stocks is complicated by their sympatric distribution, and the hardly controllable mating behaviour. Therefore, introgression from one subspecies to another cannot be excluded (Soland-Reckeweg *et al*., 2004). Gene flow between a subspecies and another is potentially influenced by natural selection and beekeeping practices (Franck, 2004). Queens randomly choose their mates suggesting an absence of homogamy (Franck, 2004). The analysis on wing shapes revealed significant information on population differentiation.

Results revealed that Ton L was the only character that increased in all districts through 2007 than 2006 by (0.19 to 0.69 mm). This increasing in Ton L may be due to the changes in environmental conditions as well as in studied queens. This result are agree with the findings of Marghitas *et al*. (2008), who stated that tongue length was considered a very important character because it shows the geographical variability more accurate than all the other characters. Morimoto (1968) mentioned that Ton L is, an important character, showing higher geographic variability upon which the quantity of nectar gathered depends. Also, Souza *et al.* (2002) stated that the variation between tongue lengths may be important in the exploitation of the environmental resources.

When data of 2006 and those of 2007 were summed (as presented in **Table 3**), they indicated that there were differences among districts, in measurements of all studied morphological characters of honey bee workers. Ton L means ranged from 5.59 mm (El-Mahmoudia) to 5.88 mm (Kafer El-Dawar). FWL means ranged from 8.67 mm (El-Dalangat) to 8.82 mm (Etay El-Baroud), while FWW means ranged from 2.94 mm (El-Dalangat) to 2.99 mm (Damanhour and Kafer El-Dawar). HWL means ranged from 6.06 mm (Kafer El-Dawar) to 6.15 mm (Etay El-Baroud), while HWW means ranged from 1.69 mm (Etay El-Baroud) to 1.82 mm (Kafer El-Dawar). CA means ranged from 0.48 mm (Damanhour) to 0.53 mm (Etay El-Baroud), while CB means ranged from 0.17 mm (Damanhour) to 0 .19 mm (Etay El-Baroud and Kafer El-Dawar). CI means ranged from 2.76 (Kafer El-Dawar) to 3.12 (El-Dalangat). DC means ranged from 0.80 mm (Damanhour and Etay El-Baroud) to 0.82 mm (El-Dalangat and Kafer El-Dawar), while DD means ranged from 1.84 mm (Hosh Esa) to 1.90 mm (El-Mahmoudia). NH means ranged from 19.87 (Kafer El-Dawar) to 21.00 (Damanhour). FL means ranged from 2.21 mm (El-Dalangat) to 2.26 mm (Damanhour), while TL means ranged from 2.79 mm (El-Dalangat and Etay El-Baroud) to 2.87 mm (El-Mahmoudia). BL means ranged from 2.09 mm (El-Dalangat and Kafer El-Dawar) to

2.16 mm (El-Mahmoudia), while BW means ranged from 1.08 mm (Damanhour) to 1.12 mm (El-Dalangat and El-Mahmoudia). Statistical analysis of morphological characters showed significant differences among locations (P<0.05) except four characters: FWW, CB, CI and DC.

Table (1): Morphological characters of honey bee workers from different districts at El-Beheira Governorate during 2006.

Morphological characters	District (Mean ± S.D.)**						El-Beheira (Mean ± S.D.)
	Damanhour	Etay El-Baroud	El-Mahmoudia	Hosh Esa	El-Dalangat	Kafer El-Dawar	
Ton L	5.46 ± 0.15 c*	5.47 ± 0.12 c	5.24 ± 0.06 d	5.60 ± 0.26 bc	5.68±0.17 ab	5.79±0.09 a	5.54 ±0.19
FWL	8.86 ± 0.09 a	8.82 ± 0.09 ab	8.76 ± 0.10 bc	8.73 ± 0.06 cd	8.62±0.04 e	8.65±0.10 de	8.75± 0.09
FWW	3.00 ± 0.07 ab	2.98 ± 0.06 abc	3.03 ± 0.04 a	3.02 ± 0.03 ab	2.92±0.05 c	2.96±0.06 bc	2.99± 0.04
HWL	6.18 ± 0.10 a	6.13 ± 0.04 ab	6.16± 0.04 a	6.12 ± 0.06 ab	6.05±0.06 c	6.09±0.03 bc	6.13±0.05
HWW	1.82 ± 0.08 ab	1.72 ± 0.05 c	1.79 ± 0.07 b	1.85 ± 0.04 a	1.71±0.04 c	1.84±0.03 ab	1.79±0.06
CA	0.50 ± 0.03 b	0.53 ± 0.01 a	0.51 ± 0.01 ab	0.50 ± 0.01 b	0.52±0.02 ab	0.51±0.02 ab	0.51 ±0.01
CB	0.18 ± 0.02 ab	0.20 ± 0.01 a	0.17 ± 0.02 bc	0.16 ± 0.03 bc	0.15±0.01 c	0.18±0.01 ab	0.19±0.02
CI	2.93 ± 0.74 bc	2.54 ± 0.14 c	3.09 ± 0.50 b	3.38± 0.86 ab	3.79±0.35 a	2.87±0.37 bc	3.10 ±0.43
DC	0.80 ± 0.02 b	0.81 ± 0.01 ab	0.79 ± 0.02 b	0.81 ± 0.01 ab	0.83±0.03 a	0.83±0.02 a	0.81±0.03
DD	1.85 ± 0.03 c	1.91 ± 0.03 a	1.89 ± 0.04 ab	1.87 ± 0.03 bc	1.89±0.02 ab	1.90±0.02 ab	1.89±0.01
NH	20.85 ± 0.48 a	20.36 ± 0.33 ab	20.24 ± 0.79 b	20.59 ± 0.33 ab	19.41±0.29 c	19.55±0.26 c	20.17±0.57
FL	2.28 ± 0.04 ab	2.24 ± 0.06 bc	2.29 ± 0.06 a	2.25 ± 0.02 abc	2.22±0.01 c	2.22±0.05 c	2.25±0.03
TL	2.82 ± 0.06 bc	2.80 ± 0.04 bc	2.91 ± 0.04 a	2.83 ± 0.04 b	2.78±0.04 c	2.81±0.04 bc	2.83±0.04
BL	2.14 ± 0.03 b	2.08 ± 0.02 cd	2.18 ± 0.04 a	2.11 ± 0.03 bc	2.07±0.03 d	2.07±0.04 d	2.11± 0.05
BW	1.09 ± 0.04 a	1.10 ± 0.03 a	1.11 ± 0.01 a	1.11± 0.01 a	1.12±0.02 a	1.12±0.02 a	1.11± 0.01

* Means in the same row followed by the same letter(s) are not significantly different according to L.S.D test at 0.05 level of probability.

** All Characters are in units of (mm) except CI and NH.

As shown in **Table 3**, honey bee workers sampled from Kafer El-Dawar district recorded the highest mean values of 4 characters: Ton L (5.88 mm), FWW (2.99 mm), HWW (1.82 mm), and DC (0.82

mm). Also, honey bee workers sampled from El-Mahmoudia district recorded the highest mean values of 4 characters: DD (1.9 mm), TL (2.87mm), BL (2.16 mm), and BW (1.12 mm). Honey bee workers sampled from Damanhour district had the highest mean values of 3 characters: FWW (2.99 mm), NH (21), and FL (2.26 mm). Also, honey bee workers sampled from El-Dalangat had the highest mean values of 3 characters: CI (3.12), DC (0.82 mm), and BW (1.12 mm). Honey bee workers sampled from Etay El-Baroud district had the highest mean values of 2 characters: FWL (8.82 mm) and HWL (6.15 mm). On contrary, honey bee workers obtained from Hosh Esa did not record any highest mean values among all of the studied characters. There are certain morphological characters important in gathering the nectar and pollen. Tongue length, wing length and width, and hind leg measurements are examples of these characters. Bees with bigger leg and wing have higher power flight and could gather more pollen and nectar for brood rearing and consequently colony population (Mostajeran *et al*., 2006). There is a positive correlation between honey production and corbicular area (Milne and Pries, 1984). Also, Szabo and Lefkovich (1987) found that honey production had significant and

positive correlations with both fore and hind wing area. So, honey production would be improved by selection for colonies that have bees with bigger leg and wing (as found in certain districts). On the contrary, some characters did not correlate with honey production as Cubital index (Bienefeld and Pirchner, 1992).

Table (2): Morphological characters of honey bee workers from different districts at El-Beheira Governorate during 2007.

Morphological characters	District (Mean ± S.D.)**						El-Beheira (Mean ± S.D.)
	Damanhour	Etay El-Baroud	El-Mahmoudia	Hosh Esa	El-Dalangat	Kafer El-Dawar	
Ton L	6.05 ± 0.07 a*	5.97 ± 0.08 bc	5.94 ± 0.09 bc	5.92 ± 0.08 c	5.94±0.05 bc	5.98±0.07 b	5.97 ±0.05
FWL	8.71 ± 0.09 a	8.82 ± 0.02 a	8.72 ± 0.06 a	8.73 ± 0.07 a	8.72±0.03 a	8.74±0.01 a	8.74± 0.04
FWW	2.98 ± 0.03 ab	2.92 ± 0.03 b	2.88 ± 0.04 b	2.90 ± 0.02 ab	2.96±0.02 ab	3.03±0.09 a	2.93± 0.06
HWL	6.05 ± 0.05 a	6.16 ± 0.04 a	6.10 ± 0.04 a	6.11 ± 0.03 a	6.15±0.05 a	6.04±0.06 a	6.10±0.05
HWW	1.71 ± 0.05 bc	1.67 ± 0.01 c	1.76 ± 0.06 ab	1.78 ± 0.04 a	1.77±0.03 a	1.80±0.01 a	1.74±0.05
CA	0.47 ± 0 .01 b	0.53 ± 0.04 a	0.53 ± 0.02 a	0.52 ± 0.02 a	0.51±0.02 a	0.52±0.05 a	0.51±0.02
CB	0.15 ± 0.01 d	0.18 ± 0.03 c	0.19 ± 0.04 bc	0.20 ± 0.02 ab	0.21±0.01 a	0.19±0.01 bc	0.18±0.02
CI	3.19 ± 0.44 a	3.02 ± 1.15 ab	2.81± 1.14abc	2.58 ± 0.28 bc	2.45±0.20 c	2.64±0.28 bc	2.78 ±0.28
DC	0.81 ± 0.02 ab	0.80 ± 0.01 b	0.83 ± 0.02 a	0.81 ± 0.01 ab	0.82±0.01 ab	0.82±0.02 ab	0.81±0.01
DD	1.86 ± 0.02 a	1.87 ± 0.04 a	1.91 ± 0.01 a	1.82 ± 0.04 a	1.86±0.04 a	1.85±0.03 a	1.86±0.03
NH	21.15 ± 1.05 a	20.12 ± 1.15 b	20.51 ±1.28ab	20.47 ± 1.55 ab	20.69±1.36 ab	20.20 ±1.12 b	20.52±0.37
FL	2.24 ± 0.04 a	2.24 ± 0.03 a	2.22 ± 0.02 a	2.22 ± 0.02 a	2.21±0.02 a	2.28±0.01 a	2.23±0.02
TL	2.79 ± 0.03 c	2.79 ± 0.02 c	2.84 ± 0.02 ab	2.85 ± 0.01 a	2.80±0.01 bc	2.82±0.01abc	2.81±0.02
BL	2.07 ± 0.04 a	2.14 ± 0.03 a	2.14 ± 0.03 a	2.09 ± 0.03 a	2.12±0.02 a	2.11±0.05 a	2.15± 0.08
BW	1.07 ± 0.03 b	1.11 ± 0.01 ab	1.12 ± 0.03 a	1.11 ± 0.01 ab	1.11±0.01 ab	1.10±0.01 ab	1.10± 0.02

* Means in the same row followed by the same letter(s) are not significantly different according to L.S.D test at 0.05 level of probability.

** All Characters are in units of (mm) except CI and NH.

2. Overall means of morphological characters of El-Beheira honey bees.

Results of all samples from 96 colonies of 6 districts at El-Beheira Governorate are presented in **Table 3**. The obtained results of El-Beheira honey bees showed that the overall mean of Ton L was found to be 5.76 mm. The longest tongue during the two years of study was found to be 5.98 mm, while the shortest one was 5.25 mm. The overall mean of FWL was found to be 8.75 mm. The longest

forewing was found to be 8.86 mm, while the shortest one was 8.83 mm. The overall mean of FWW was found to be 2.96 mm. The widest forewing was found to be 3.04 mm, while the narrowest one was 2.92 mm. The overall mean of HWL was found to be 6.12 mm. The longest hind wing was found to be 6.19 mm, while the shortest one was 6.04 mm. The overall mean of HWW was found to be 1.77 mm. The widest hind wing was found to be 1.85 mm, while the narrowest one was 1.67 mm. The overall mean value

Table (3): The overall means (of 2006 and 2007) of morphological characters of honey bee workers from different districts.

Morphological characters	District (Mean)**						El-Beheira (Mean ± S.D.)
	Damanhour	Etay El-Baroud	El-Mahmoudia	Hosh Esa	El-Dalangat	Kafer El-Dawar	
Ton L	5.76 ab*	5.72 ab	5.59 b	5.76 ab	5.81 a	5.88 a	5.76±0.30
FWL	8.79 ab	8.82 a	8.74 abc	8.73 abc	8.67 c	8.70 bc	8.75±0.01
FWW	2.99 a	2.95 a	2.96 a	2.96 a	2.94 a	2.99 a	2.96±0.04
HWL	6.12 ab	6.15 a	6.13 a	6.12 ab	6.10 ab	6.06 b	6.12±0.02
HWW	1.76 abc	1.69 c	1.77 ab	1.81 ab	1.74 bc	1.82 a	1.77±0.03
CA	0.48 b	0.53 a	0.52 a	0.51 a	0.51 a	0.51 a	0.51±0.01
CB	0.17 a	0.19 a	0.18 a	0.18 a	0.18 a	0.19 a	0.18±0.01
CI	3.06 a	2.78 a	2.95 a	2.98 a	3.12 a	2.76 a	2.94±0.23
DC	0.80 a	0.80 a	0.81 a	0.81 a	0.82 a	0.82 a	0.81±0.01
DD	1.85 b	1.89 a	1.90 a	1.84 b	1.87 ab	1.87 ab	1.88±0.02
NH	21.00 a	20.24 bc	20.37 bc	20.53 ab	20.05 bc	19.87 c	20.34±0.25
FL	2.26 a	2.24 ab	2.25 a	2.23 ab	2.21 b	2.25 a	2.24±0.01
TL	2.80 bc	2.79 c	2.87 a	2.84 ab	2.79 c	2.81 bc	2.82±0.01
BL	2.11 ab	2.11 ab	2.16 a	2.10 b	2.09 b	2.09 b	2.13±0.03
BW	1.08 b	1.10 ab	1.12 a	1.11 a	1.12 a	1.11 a	1.11±0.01

* Means in the same row followed by the same letter(s) are not significantly different according to L.S.D test at 0.05 level of probability.
** All Characters are in units of (mm) except CI and NH.

of CI was found to be 2.94. The highest value of cubital index was found to be 3.79, while the smallest one was 2.54. The overall mean of DC was found to be 0.81 mm. The longest distance C was found to be 0.83 mm, while the shortest one was 0.79 mm. The overall mean of DD was found to be 1.88. The longest distance D was found to be 1.91 mm, while the shortest one was 1.82 mm. The overall mean value of NH was found to be 20.34. The highest value of number of hooks was found to be 21.15, while the smallest one was 19.42. The overall mean of FL was found to be 2.24 mm. The longest femur was found to be 2.29 mm, while the shortest one was 2.21 mm. The overall mean of TL was found to be 2.82 mm. The longest tibia was found to be 2.78 mm, while the shortest one was 2.91 mm. The overall mean of BL was found to be 2.13 mm. The longest basitarsus was found to be 2.31 mm, while the shortest one was 2.07 mm. The overall mean of BW was found to be 1.11 mm. The widest basitarsus was found to be 1.13 mm, while the narrowest one was 1.13 mm.

When all morphological characters were considered, honey bee samples from different locations at El-Beheira Governorate formed an intermingled cluster. Our results show a great deal of variations among bees collected from different locations. This probably reflects the mixing of bees from different regions, resulting from transport of colonies during the flowering period of Citrus and sometimes during the last period of Clover. As migratory beekeeping becomes more common, differences among domestic races and ecotypes are increasingly obscured. In other words, migratory beekeeping, practiced on a large scale especially in Citrus orchards located at many areas of El-Beheira Governorate, could make the gene pools of El-Beheira bee populations homogenized and genetic variations may getting lost. In general, the results of our investigation show that honey bee populations at El Beheira Governorate are mixed. This may be due to beekeeping manipulations (migratory beekeeping and commercial breeding (Bouga *et al.*, 2004; Hatjina *et al.*, 2004). Moreover, El Beheira honey bees are kept for last decades under conditions of open mating of queens. The most important threat to the protection of the autochthonous bees is introduction of the other breeds or even hybrids through trade of breeding material and migratory beekeeping (Drazic *et al.*, 2004). The gene pools of the

Turkish bee populations are becoming homogenized and genetic variation is getting lost, since techniques of migratory beekeeping have improved in recent years (Sirali *et al.*, 2003).

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الملخص العربي

الصفات المورفولوجية لمجموع نحل العسل *Apis mellifera* L. فى محافظة البحيرة

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تم دراسة الصفات المورفولوجية لشغالات نحل العسل .L *Apis mellifera* التى تم جمعها من 48 طائفة تمثل 6 مراكز فى محافظة البحيرة (دمنهور، الدلنجات، المحمودية، إيتاى البارود، حوش عيسى، كفر الدوار) خلال عامين (2006، 2007) وذلك لتوصيف مجموع نحل العسل بمحافظة البحيرة. تم اختيار 15 صفة مورفولوجية. وتم قياسها بواسطة تقنية Scan Photo technique. وأظهر التحليل الإحصائي وجود اختلافات معنوية (عند مستوى معنوية 5 %) بين المراكز فى كل الصفات المورفولوجية خلال موسم 2006 فيما عدا عرض الرسغ القاعدى للرجل الخلفية (BW). ومن ناحية أخرى وجدت اختلافات معنوية (عند مستوى معنوية 5 %) بين المراكز خلال موسم 2007 فيما عدا خمس صفات وهى طول الجناح الأمامي (FWL)، طول الجناح الخلفى (HWL)، المسافة D (DD) بالجناح الأمامي، طول فخذ الرجل الخلفية (FL)، طول الرسغ القاعدى للرجل الخلفية حيث كانت الاختلافات بها غير معنوية. وأظهرت النتائج خلال عامي الدراسة على مستوى كل المراكز أن متوسط طول اللسان (Ton L) تراوح من 5.24 إلى 6.05 مم، متوسط طول الجناح الأمامي تراوح من 8.65 إلى 8.86 مم، متوسط عرض الجناح الأمامي (FWW) تراوح من 2.88 إلى 3.03 مم، متوسط طول الجناح الخلفى تراوح من 6.04 إلى 6.18 مم، متوسط عرض الجناح الخلفى (HWW) تراوح من 1.67 إلى 1.85 مم. وكانت قيم أعلى متوسطات لدالة الجناح (CI) و عدد الخطاطيف (NH) هى 3.38، 21.15 بينما قيم أقل متوسطات كانت 2.45، 19.41 على الترتيب. ومن ناحية أخرى كانت أعلى متوسطات لطول المسافة C (DC) و طول المسافة D هى 0.83، 1.91 مم بينما أقل متوسطات كانت 0.79، 1.82 مم على الترتيب . وأظهرت النتائج أن أعلى متوسط لطول فخذ الرجل الخلفية المسافة كان 2.29 مم بينما أقل متوسط كان 2.21 مم. وكان أعلى متوسط لطول ساق الرجل الخلفية (TL) هو 2.91 مم بينما أقل متوسط 2.78 مم. ومن ناحية أخرى أظهرت النتائج أن أعلى وأفل متوسطات لطول الرسغ القاعدى للرجل الخلفية كانت 2.18، 2.07 مم مقارنة ب 1.12، 1.07 مم لعرض الرسغ القاعدى (BW) على الترتيب.

Keywords : نحل العسل، الصفات المرفولوجية، تقنية Scan Photo technique.