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Identification of Honeybees, *Apis Mellifera* L. Based on Some Morphometric Analysis

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ABSTRACT

The honeybee *(Apis mellifera* L.*)* one of the most vital societal insects. The importance of honeybee is the major pollinators, agricultural productions and honey production in worldwide. Nine different districts were randomly selected from El-Beheira governorate, Egypt to assess the subspecies and identification percent of mixing among colonies via estimating cubital index characters to determinate honeybees' races. Overall means were 2.52. Analysis of variance is highly Significant differences (*P value =0.00*) at according to Tukey's Studied Range (HSD) test (α=0.05) for the different locations. overall percentage for previous districts, the highest percent was 28.51% for the group of *A. m. ligustica* or *A, m. carnica*, 21.54% for *A. m. mellifera*. Also, the category of *A. m. lamarkii* percentage is 17.13%. Furthermore, *A. m. yemenitica* or *syriaca* category, multiplied by the percentage of 16.41%. The percentage of 16.41% for the of *Apis mellifera spp.* we indicate that the Egyptian honeybee "*A.m. lamarkii*" percentage was lower than *A. m. carnica and A. m. ligustica* in Egypt.

Keywords: *Apis mellifera* Races, Morphometric characters, cubital index, El-Beheira and Egypt.

1. Introduction

Honey bee one of the most vital societal insects. The importance of honey bee is the major pollinators and are important for numerous agricultural. Worldwide, insect pollination is estimated around 9.5 % and honey productions. Honey world production about 1.4 million tons/ year (Gallai *et al.,* 2009) (FAO/WHO, 2007)**.** In Africa, honeybees are the very important hive products and is the major tool of producers venturing in beekeeping. (Sagwa, 2021).

In fact, National honeybee is *Apis mellifera lamarkii* since 5000 years. This *A. m. lamarkii is* lived in the local circumstances of the region. Then it was prevalent out Egypt (Hassona, 2017). Morphometric methods showed a vital role for classification honeybee subspecies. *Apis mellifera* spp. are different based on behavior, physiological and morphological several taxonomy tool for example biochemical and morphometrics (Salehi and Nazemi-Rafie 2020; Ruttner, 1988). Estimating morphometric characters of honey bee in different time is very vital for races (Abou-Shaara and Ahmed, 2015). In Egypt, *A. m. lamarkii* is being bred in a limited region of Assuit 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 (Eid *et al.,* 2010).

To classify and compare the honeybee populations of Turkey, Syria and Iran based on their morphometric traits along the common border in the Southeast of Turkey (Ozbakır and Fıratlı, 2013) used the univariate analysis and their results demonstrated that there are significant different between all the studies characters of honeybee samples (P <0.001) from the different locations. Cubital index is an essential characteristic of the wing veins used for determination of honey bees' subspecies (Zaja *et*

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al., 2017). Therefore, this current study aimed to identify the types of the honeybee races *Apis mellifera* subspecies based on cubital index character from different location in El-Beheira governorate, Egypt used to Scan Photo technique to investigate the morphometric variability of national honeybee.

2. Materials and Methods

2.1. Study area and Sample collection

From each apiary collected 5 colonies with 30 honeybee workers. Samples collected in summer 2019 at nine districts from ElBehira governorate, Table 1 and Figure 1. Usually, 10 honeybee workers from 5 to 6 colonies per colony was measured in morphometric studies. As a minimum, 30 wing Estimating per colony was measured. furthermore, from 30:50 (Hassona, 2012**;** Meixner *et al.,* 2007; Smith *et al.,* 1997).

Table 1: Samples number of honeybees collected from El-Beheira governorate for morphometric analysis.

Districts	Apiary №	Colony №	Worker №
Damanhour	2.0	10.0	300
Shubrakhit	1.0	5.0	150
Abu Al Matamir	2.0	10.0	300
Abu Hummus	1.0	5.0	150
Idku	2.0	10.0	300
Kom Hamada	2.0	10.0	300
Badr	1.0	5.0	150
Itay Al Barud	1.0	5.0	150
Nubariyah	1.0	5.0	150
Total	13	65	1650

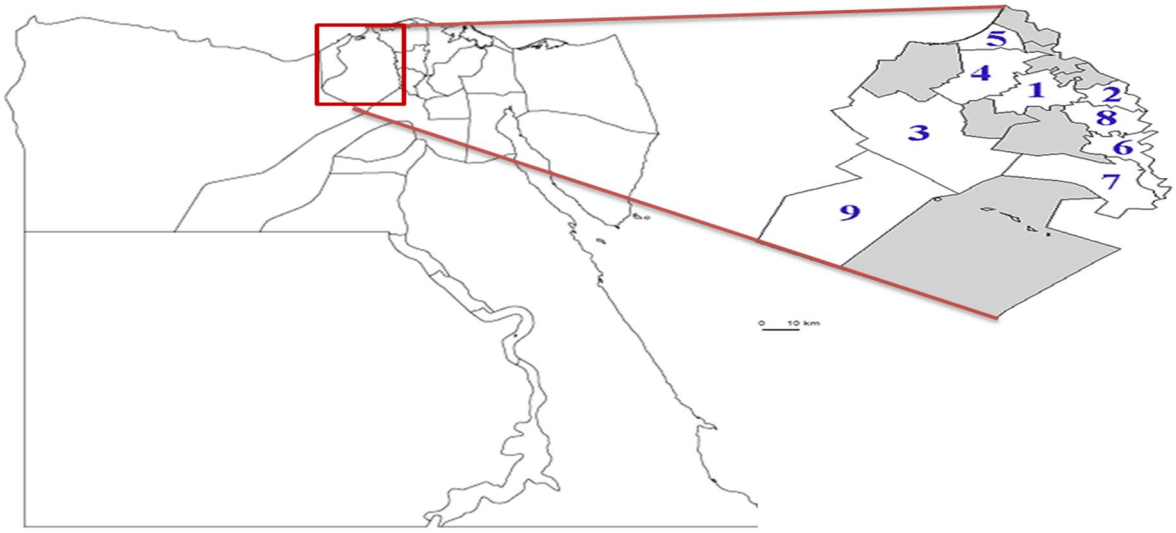

Fig. 1: Localities which worker honeybees collected for analysis in current study. (1) Damanhour, 31.0393°N 30.4674°E; (2) Shubrakhit, 31.0272°N 30.7136°E; (3) Abu Al Matamir, 30.9081°N 30.1743°E; (4) Abu Hummus, 31.0834°N 30.3097°E; (5) Idku, 31.3043°N 30.3004°E; (6) Kom Hamada, 30.7574°N 30.6978°E; (7) Badr, 30.5766°N 30.7115°E; (8) Itay Al Barud, 30.8857°N 30.6632°E and (9) Nubariyah, 30.6667°N 30.0667°E

2.2. Cubital index determination:

The forewings were transferred to transparent paper, scanned them with computer, Hp scanner, then transferred them to ImageJ v.1.52a program (Rasband, 2017) as a photo to measure the part a (C-B) and part b (B-A). After that, the measurements putted in Excel sheet to calculate the value of cubital index (a/b) in each wing for each worker sample (Figure 2). The data were in Excel sheet divided into

special categories of cubital index (≥ or ≤ 2.00 to 4.5) for *Apis mellifera* sp. (Ruttner, 1986) to indicate the frequency and variety of the (cubital index) in different experimented colonies.

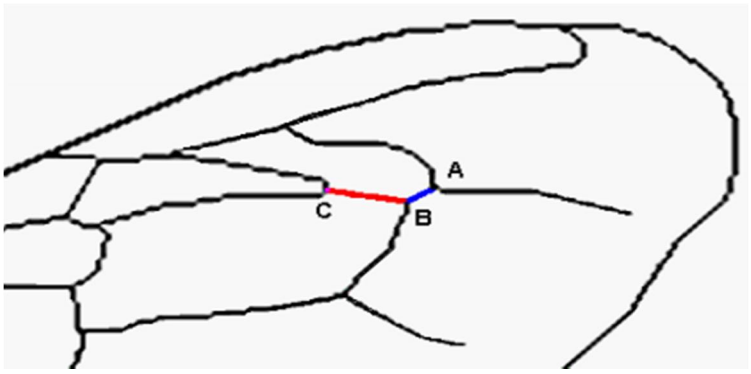

Fig. 2: Cubital index (CI=cb/ba) in the forewing of honey bee worker (the photo was taken by (Hassona, 2017).

2.3. Statistical analysis

The statistical analysis by SPSS program v 25.0 (IBMCorp, Released 2017). The obtained data were statistically analyzed by calculating the means. Analysis of variance "ANOVA" was carried out to check the significant differences between the samples. The Tukey's Studied Range (HSD) test was determined in p=0.05. The percent ratio of the multiplied computed in the current samples.

3. Results and Discussion

3.1. Biometric analysis of Cubital index (CI)

Results in Table 2 showed that the means of cubital index (C.I) were 2.69, 2.54, 2.71, 2.65, 2.30, 2.43, 2.46, 2.53 and 2.36 ratio for Damanhour, Shubrakhit, Abu Al Matamir, Abu Hummus, Idku, Kom Hamada, Badr, Itay Al Barud and Nubariyah, respectively. The maximum means was documented for the colonies belonging to Abu Al Matamir district (2.71±0.61), whereas the minimum was (2.30±0.46) in Idku district. Analysis of variance (ANOVA) in Table 2 and Figure 3 presented very highly Significant differences (*P value =0.00*) for the different locations was and F. value was 20.4.

The results demonstrated a significant difference between the samples collected from Abu al Matamir, Shubrakhit, on the other hand, the results indicated that there are no significant between (Idku with Nubariyah) and (Kom Hamada with Badr). Also, there are no significant between Damanhour, Abu al Matamir and Abu Hummus. Such as, there was significant between the samples collected from Idku and Itay al Barud. The overall means of CI ranged among (2.12 to 2.67) at El-Manzla in El-Dakahlia Government (Hassona, 2017). In Beheira Governorate, the cubital index(CI) ranged among 2.45 to 3.38 reported by (Eid *et al.,* 2010).

Table 2: Descriptive statistics and compare means of cubital index for the honeybee forewings

Biometric analysis Districts	Mean	S.D	min	max	General mean	F Value	*P* Value
Damanhour	2.69^{ab}	0.62	1.69	4.79			
Shubrakhit	2.54^{bcd}	0.51	1.47	4.26			
Abu Al Matamir	2.71^{a}	0.61	1.41	4.63			
Abu Hummus	2.65^{abc}	0.56	1.45	4.98			
Idku	2.30^{e}	0.46	1.31	4.87	**2.52**	**20.4**	**0.00**
Kom Hamada	2.43^{de}	0.46	1.6	3.97			
Badr	2.46^{de}	0.4	1.74	4.31			
Itay Al Barud	2.53^{cd}	0.46	1.73	4.03			
Nubariyah	2.36^{e}	0.39	1.48	3.62			

* Means in the same column followed by the same letter(s) are not significantly different according to Tukey's Studied Range (HSD) test (α=0.05).

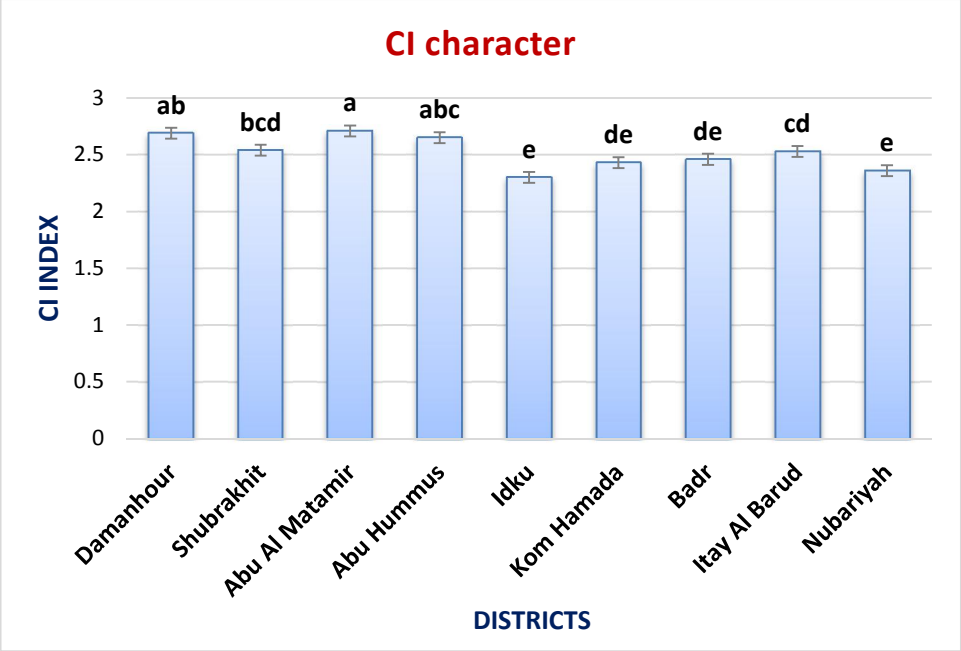

Fig. 3: Overall means for cubital index for different districts, El-Beheira governorates.

3.2. Percentage of *A. m. subspecies* in the nine districts at El-Beheira governorate

Cubital index category of *Apis mellifera* (1.65 - 2.95) corresponding to Rinderer, (1986). When it's compared mean with cubital index for *A. m. subspecies* category of Damanhour belong to the category of *Apis mellifera* (2.5 - 2.9). In addition, the mean CI in Damanhour, Shubrakhit, Abu Al Matamir, Abu Hummus and Italy Al Barud (2.69, 2.54, 2.71, 2.65 and 2.53) close of the category of *A.m. ligustica* or *A.m. carnica* (2.5 – 2.9). On the other hand, Idku district was (2.30) nearly to *A.m. yemenitica* or *A.m. syriaca* (2.1 – 2.3). While CI mean from Kom Hamada, Badr, and Nubariyah districts (2.43, 2.46 and 2.36) may be its closely *A. m. lamarckii* (2.3 – 2.5).

The results in Table 3 showed the highest percentage of *A. mellifera mellifera* category (1.89 - 2.00) was 37% in Idku distract. On the other hand, the lowest percentage was 13.33% in Abu Hummus distract. The highest percent Category of *A.m. yemenitica* or *A.m. syriaca* (2.1-2.3) was 21.33% in Itay Al Barud and the lowest percentage (13.00%) in Abu Al Matamir. The third category *A. m. lamarckii* "Egyptian honeybee" (2.3 -2.5) was highest in Nubariyah by 27.33% and lowest in Damanhour by 11.67%. In Badr district was the highest percentage of *A.m. ligustica* or *A.m. carnica* category (2.5 – 2.9) by 36.67% and the lowest in Idku district by 17.67%. The last category *Apis mellifera* spp. "Unknown honeybee" (2.9-3.1) is highest percent in Idku by 37.00% and the lowest percent in Abu Hummus by 13.33%.

In Table 3 and Figure 4 as showed that overall percentage for All districts, the highest percent was 28.51% for the group of *A, m. ligustica* or *A, m. carnica*, 21.54% for *A. m. mellifera*. Also, the category of *A. m. lamarkii* percentage is 17.13%. Furthermore, *A. m. yemenitica* or *syriaca* category, multiplied by the percentage of 16.41%. The percentage of 16.41% for the of *Apis mellifera* spp. The study results agreed with (Mazeed, 2011), who indicated that *Apis mellifera carnica* percentage was higher than *A.m. lamarkii* in El-Beheira, Egypt. On the other hand, the results disagree with (Hassona, 2017), who indicated that *A.m. lamarkii* was higher than *A. m. carnica* in Dakahlia governorate, Egypt. Unknown honey bees may be hybrids from different races and cannot be identified reported by (Guzman-Novoa and Page Jr, 1994).

Table 3. Percentage of *A. m. subspecies* in the nine districts in El-Beheira governorate

Apis m. subspecies	Damanhour **%**	Shubrakhit **%**	Abu Al Matamir **%**	Abu Hummus **%**	Idku **%**	Kom Hamada **%**	Badr **%**	Itay Al Barud **%**	Nubariyah **%**	***General %***
A.m. mellifera (1.89- 2.00)	17.00	20.00	13.67	13.33	37.00	26.00	17.33	16.00	26.00	21.54
A.m. yemenitica or A.m. syriaca (2.1 – 2.3)	14.33	15.33	13.00	13.33	18.33	18.33	20.67	21.33	14.67	16.41
A.m. lamarckii (2.3 – 2.5)	11.67	17.33	14.67	18.00	18.67	16.33	19.33	18.00	27.33	17.13
A.m. ligustica or A.m. carnica (2.5 – 2.9)	28.67	31.33	32.67	33.33	17.67	26.67	36.67	30.00	28.00	28.51
Apis mellifera spp. (2.9 – 3.1)	17.00	20.00	13.67	13.33	37.00	26.00	17.33	16.00	26.00	16.41

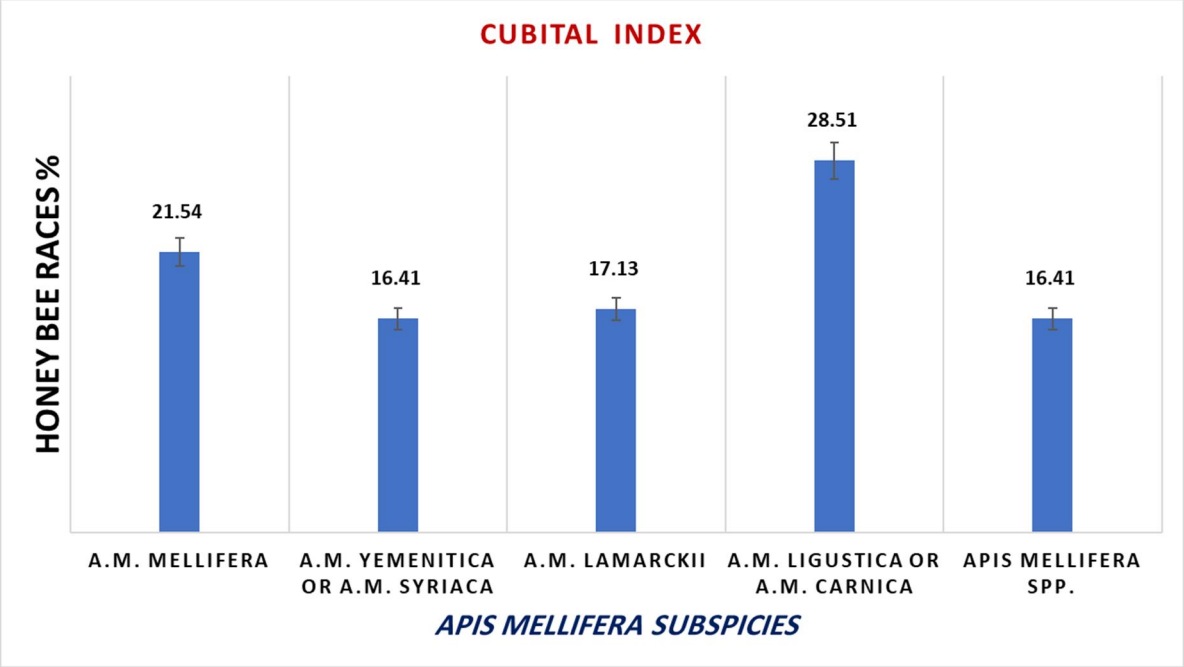

Fig. 4: Percentage of *A. m. subspecies* in El-Beheira governorate, Egypt

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Referances

Abou-Shaara, H.F., and M.E. Ahmed, 2015. Characterisation and tracking changes of morphological characteristics in honey bee, *Apis mellifera*, colonies. Journal of Entomological and Acarological Research, 47(3), 103. doi:10.4081/jear.2015.5120

Eid, K., K. Draz, M. El-Aw, and H. Abou-Shaara, 2010. Morphological characters of honey bee, *Apis mellifera* L., population in EL-Beheira Governorate. J. of Agric. and Env. Sci., Alex. Univ., Egypt, 9(2): 25-43 .

FAO/WHO., 2007. *Evaluation of certain food additives and contaminants: sixty-eighth report of the Joint FAO/WHO Expert Committee on Food Additives* (Vol. 68): World Health Organization.

Gallai, N., J.-M. Salles, J. Settele, and B.E. Vaissière, 2009. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. Ecological Economics, 68(3), 810-821. doi:https://doi.org/10.1016/j.ecolecon.2008.06.014

Guzman-Novoa, E., and R.E. Page Jr, 1994. Genetic dominance and worker interactions affect honeybee colony defense. Behavioral Ecology, 5(1): 91-97 .

Hassona, N.M., 2012. Mating efficiency of honey bee, Abis mellifera L. Queens. (Ph.D. Thesis), Fac. Agric. (Saba Basha), Alex. Univ., Egypt .

Hassona, N.M.K., 2017. Cubital Index Determination of some Honey Bee Races *Apis mellifera* subspecies at El-Manzla Region in El-Dakahlia Governorate, Egypt. Journal of Plant Protection and Pathology, 8(12): 625-629 .

IBMCorp. (Released 2017). IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp .

Mazeed, A.M.،2011 .Anomalies and asymmetry of wing venation pattern in Carniolan and Egyptian bee populations in Egypt. Egyptian Academic Journal of Biological Sciences. A, Entomology, 4(1): 149-161 .

Meixner, M.D., M. Worobik, J. Wilde, S. Fuchs, and N. Koeniger, 2007. (*Apis mellifera* mellifera in eastern Europe–morphometric variation and determination of its range limits. Apidologie, *38*(2) : 191-197 .

Ozbakır, G., and Ç. Fıratlı, 2013. Morphometric Classification of Honeybee Populations (*Apis mellifera* L.) Along the Southeast border of Turkey. Bulg. J. Agric. Sci, 19(6): 1396-1400 .

Rasband, 2017. ImageJ, v. 1.52 a, National Institutes of Health, Bethesda, MD, USA.

Rinderer, T.E., 1986. Book of bee genetics and breeding. *Academic Press, INC. Harcourt Brace Jovanovich, Publishers. Orlando, Florida 32887.U.S.A* .

Ruttner, F., 1986. Geographical variability and classification. Bee genetics and breeding, 23-56.

Ruttner, F., 1988. Biogeography and taxonomy of honeybees Springer. *Berlin, Germany* .

Ruttner, F., M.P. Elmi, and S. Fuchs, 2000. Ecoclines in the Near East along 36$^{\circ} $ N latitude in *Apis mellifera* L. Apidologie, 31(2) : 157-165 .

Sagwa, C.B., 2021. Bee populations, genetic diversity, conservation, marketing and contribution to rural households in Kenya: a review. International Journal of Tropical Insect Science, 41(2), 933-943. doi:10.1007/s42690-020-00389-0

Smith, D., B. Crespi, and F. Bookstein, 1997. Fluctuating asymmetry in the honey bee, *Apis mellifera*: effects of ploidy and hybridization. *Journal of Evolutionary Biology, 10*(4) : 551-574 .

Zaja, M., H. Kiprijanovska, B. Dolgoski, E. Angelova, and A. Uzunov, 2017. Determination of the cubital index at honey bees from autochthonous population (*Apis mellifera* macedonica) in Mariovo region. Journal of Hygienic Engineering and Design, 18: 49-53 .