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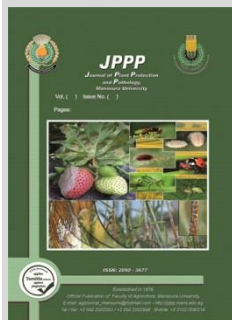
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Morphometrical Studies on the Egyptian Honeybee *Apis mellifera lamarckii*

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ABSTRACT

Morphological characteristics of honey bee worker are important traits for breeding systems and useful for discriminating subspecies and ecotypes. During the season 2023, the present investigation took place at the Faculty of Agriculture at Al-Azhar University. Bees were collected from apiaries in the Assiut governorate region of Egypt to determine some Morphometrical characteristics proboscis length, Flagillum length, Total length of antenna, head width length, forewing length and width, hind wing length and width, numbers of hamuli, Cubital index, Femur length, Tibia length hand width, basitarsus length and width, hind leg length, first wax gland length and width, third sternum length and width. All bee samples were placed into a -20°C freezer at the laboratory until it was dissected for separation (Proboscis, forewing, hind wing, and hind leg). The results showed that the mean values were: Proboscis length 5.69 ± 0.010 mm.; forewing length of 8.46 ± 0.019 mm. and width 2.93 ± 0.012 mm.; cubital index 2.29 ± 0.028 mm ; numbers of hamuli on hind wing 22.33 ± 0.16 ; first wax-gland length 1.35 ± 0.006 mm. and width 2.12 ± 0.016 mm. Hybrid bees can be distinguished by this character if they have Egyptian ancestry. The Egyptian honeybee in Assiut can be considered slightly non pure race.

Keywords: *Apis mellifera Lamarckii*, Morphological characteristics, forewing length, proboscis length.

INTRODUCTION

The Western honey bee (*Apis mellifera* L.) is a profoundly variable species, with around 31 perceived races (Chen et al., 2016, Eimanifaretal., 2018, Engel, 1999, Hepburn and Radloff, 1998, Meixneretal., 2011, Ruttner, 1988, Sheppard and Meixner, 2003). Inside species, there are also ecotypes and reproducing lines, which are significant regarding the conservation planning and sustainable practice of original strains (Dukku and Danailu, 2020, Ilyasovetal., 2020).

Currently, Egypt has three varieties of honey bees: the indigenous honey bees (*Apis mellifera lamarckii*), the carniolan hybrid honey bees (*Apis mellifera carnica*) and the Italian hybrid honey bees (*Apis mellifera ligustica*).

According to Lamarck's bee, she is an excellent housekeeper, but produces a poor amount of honey. As a result, the Carniolan honeybee gained popularity on account of its peaceable nature as well as ease of management in ultramodern Langstroth hives, replacing the *Ammophilus lamarckii* in marketable beekeeping in Egypt.

In response, there have been populations of native honeybees suppressed in Egypt, which are mostly found near Assiut, specifically in the Manfalut area bordered by European hybrids. In comparison to *A.m. Lamarckii*, its legs are shorter and its wings are longer. A colony of its species has fewer bees than a colony of the European species. A nocturnal species never forms winter clusters or stores food, and it is constantly reproducing throughout the year. This species is considered to be of tropical African bees in general (Schmolz et al., 2001). There are two main differences between Egyptian and European honeybees: Egyptians exhibit a much stronger protective response and A.M. larvae develop more rapidly; this means they tolerate the serious and dangerous

pests invading *Apis mellifera* species, the *Varroa destructor* mites. (Simonthomas and Simonthomas, 1980).

Honey bees must maintain a high level of inheritable diversity among their worker class if they are to survive. During the inbreeding process, inheritable diversity is lost, which leads to colonies with reduced heritable variety being less proficient at controlling hive terrain (Jones et al., 2004, Jones et al., 2005, Taha and AL-Kahtani, 2019). They are also more likely to contract diseases (Bienefeld et al., 1989, Desai et al., 2015). Similarly, its decline in heritable variety could contribute to the inability of honey freak populations to adapt to new diseases, such as varroa. In order to maintain original strains in detached conservation apiaries, there is a dire need to celebrate and maintain original strains. *Apis mellifera's* morphology is essential for following colony changes over time (Abou-Shaara et al., 2012b), investigating hybridization with other species (Radloff et al., 2003), characterizing honey bee subspecies (Mixner et al., 2007), studying harmony in body corridors and identifying species (Abou-Shaara & Al-Ghamdi, 2012). A honey product can be identified by the morphological characteristics of honey bees (e.g., wings and legs; Milne & Pries, 1984; Waddington, 1989; Kolmes & Sam, 1991; Edriss et al., 2002; Mostajeran et al., 2006). Generally, bees with larger bodies produce more honey, but those with lower bones are better at forbearing thermal stress (Abou-Shaara et al., 2012a). In order to assess changes in chastity, productivity, and environmental tolerance in honey bee colonies, it is vital to measure morphological characteristics over time.

latterly, the point of this work is to assess the morphometric traits of *A.m. lamarckii* bees in the Assiut governorate region of Egypt

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MATERIALS AND METHODS

Morphological characters.

A- Samples preparing

At the Faculty of Agriculture, Al-Azhar University, an investigation was conducted during the summer of 2023. Among the last remaining hives, worker honeybee samples were collected from hives reared in pipe hives fig (1). A total of ten bees were collected from ten randomly chosen unmarked hives and marked hives. Each bee sample was placed into a -20° C freezer until it was dissected for separation (Proboscis, forewing, hindwing, and hindleg).



Figure 1. The Egyptian mud traditional hives in the only remaining apiary in Assiut governorate

B-Morphological characters.

The tested morphological characters were proboscis length, Flagillum length, Total length of antenna, head width length, forewing length and width, hind wing length and width, numbers of hamuli, Cubital index, Femur length, Tibia

length and width, basitarsus length and width, hind leg length, first wax gland length and width, third sternum length and width, Measurements of the abovementioned characters were taken according to Ruttner (1988).

C- Using A Simple Semi- Automatic Technique.

As part of the Scan Photo method, every morphological character studied was measured using a scanner (Zoom 100%, Red, Green, Blue, with a resolution of 2400 points per inch (ppi) and units of measurement (mm), connected to a laptop with a screen resolution of 1024 x 768 pixels and Photoshop software. A glass slide was used to hold the separated body parts of worker bees, and another glass slide was used to cover them. The slides were scanned and moved into the computer as images. Using Photoshop, the images were opened and characters were measured according to AboShaara's (2009) method

RESULTS AND DISCUSSION

A. The Proboscis Character Measurement:

The capability of nectar collection by honeybee worker is substantially dependent upon the length of proboscis, (tongue), which consisted of sub mentum, (lorum), mentum, prementum and alaglossa.

The length of proboscis was ranged from 5.4 to 5.9 mm., with a mean value of 5.69 ± 0.011 mm. The present proboscis values of the Egyptian honeybee worker do not differ from values that in by numerous authors. El- Banby, (1954) recorded 5.57 ± 0.02 mm. and 5.76 ± 0.01 mm. for proboscis length of Egyptian workers which reared in a natural combs and in Langstroth hive at Shebin El-Kom, (north Egypt) respectively. Wafa, et al., (1965) recorded 5.65mm ,Aly et. al., (1989) at El-Minia governorate, (Middle Egypt) recorded 5.41mm.inaddation Abdel-Rahman, (2004) at Assiut, (south Egypt), recorded 5.701 ± 0.024 mm. and 5.741 ± 0.021 mm. during seasons of 2001-2002 and 2002-2003, respectively.

B. Length of Flagellum and Total length of antenna :

Flagellum is the longest part of antenna which contains all the sense organs in honeybee. The flagellum length ranged from (2.28 – 2.72) mm. with a mean value of 2.53 ± 0.012 mm. while the Total length of antenna ranged from (3.40 - 3.93) mm. with a mean value of 3.69 ± 0.004 mm.

These findings were fairly lower than those registered Zeid and chricker, (2001) who set up that the length of flagellum of the Egyptian honeybee was between 2.60–2.80 mm .

C- Head width

The head width ranged from 3.34 to 3.90 mm. with a mean value of 3.56 ± 0.0303 mm.

These findings were fairly lower than those registered Rukhosh, (2021) who ste up that the head width of the Egyptian honeybee was mean 4.550 mm.

D. The hind leg:

Data recorded in Table (1) show the length of femur, tibia and width of tibia , metatarsus and the width of metatarsus and length of hind leg of the Egyptian worker .

The length of femur ranged from 2.24 to 2.87 mm. with average value of 2.42 ± 0.056 mm.

Tibia length that measured ranged from 2.7 to 3.00 mm. with a mean value of 2.89 ± 0.009 mm. while The width of the Tibia it ranged from 0.775 - 1.1 mm. with average value of 0.91 ± 0.029 mm.

The length of hind basitarsus for the examined workers was ranged from (1.7 -2.1) mm. while the mean values were 1.95 ± 0.01 mm. Table (1). The width of the hind basitarsus ranged from 0.9 - 1.1 mm. The average values of this point were 1.06 ± 0.0094 mm.

The Length of hind leg ranged from 6.62 to 7.77 mm. with average value of $7.26 \pm$ mm.

These returns of hind leg parameters were in accordance with those attained by Nafea et al , (2023) at Assuit governorate. he set up that the hind leg femur length was mean 2.43mm. The length of tibia was mean from 2.95 mm. the length of basitarsus mean from 1.94 mm. whiel the width were in accordance with those attained by El- Banby, (1954) recorded 1.06 mm

E. The forewing:

The length of the right forewing was measured as the sum of proximal and distal lengths of the wing. It is appeared from the data in tables (1) that the forewing length of the Egyptian worker is ranged from 8.2 to 8.8 mm. with an mean of 8.46 ± 0.019 mm. The width of the right forewing was ranged from 2.7 to 3.05 mm.

with an mean 2.93 ± 0.012 mm.

The length of the right hindwing was measured as the sum of proximal and distal lengths of the wing. It is appeared from the data in Tables (1) that the forewing length of the Egyptian worker is ranged from 5.8 to 6.4 mm. with an average of 6.12 ± 0.026 mm. The width of the right hind wing was ranged from 1.7 to 1.9 mm. with an mean of 1.83 ± 0.005 mm.

The right hind wing was attached to the hind wing by a numbers of hamuli ranged from 19 to 25 with an average of 22.33 ± 0.161 .

The cubital index of the Egyptian worker surfaced in was ranged from 1.7 to 2.97 with a mean value of 2.29 ± 0.028 mm.

These results are in agreement with those preliminarily recorded by many investigators in Egypt. El- Banby, (1954) at El- Monofya recorded 8.140 ± 0.0145 mm. and 2.76 ± 0.006 mm. for both length and width of the Egyptian worker forewing. He also set up 20.48 ± 0.0303 for the numbers of hamuli of the hind wing and the cubital index was 2.61 ± 0.0470 . Mazed, (1964) reported the mean values of 8.36 ± 0.1918 mm., 2.84 ± 0.0933 mm., 2.46 ± 0.4331 and 21.10 ± 0.0141 for length, width, cubital index and numbers of hamuli for the forwing of the Egyptian honeybee worker. Similar results were observed by Abou- Zeid, (1990), and Abdel – Rahman, (2004).

Table 1. Morphometrical characters of the Egyptian honeybee workers reared in pipe hives

characters	Range /	Mean /	Review*20 23		Egyptian** Hassanein and el Banby(1956)	Egyptian*** Wafaet al , (1962)
			value	Reference		
L. of proboscis (mm.)	(5.4 - 5.9)	5.69 ± 0.0108	5.75	Abo Shaara,(2009)	5.57	5.65
L. of Flagillum (mm.)	(2.28 - 2.72)	2.53 ± 0.0122	2.60-2.80	Zeid and Schricker, (2001)	-	-
L. of Total length of antenna mm.	(3.40 - 3.93)	3.69 ± 0.0037	3.92	Elfeel , (2008)	-	-
L. of head width	(3.34 -3.90)	3.56 ± 0.0303	4.550	Rukhosh, (2021)	-	-
L. of Femur (mm.)	(2.24 -2.87)	2.42 ± 0.0558	2.24	Abo Shaara,(2009)	-	-
L. of Tibia (mm.)	(2.7 - 3)	2.89 ± 0.0094	2.82	Abo Shaara,(2009)	-	-
W. of Tibia (mm.)	0.775 - 1.1)	0.91 ± 0.0285	-	-	-	-
L. of basitarsus (mm.)	(1.7 -2.1)	1.95 ± 0.0165	2.13	Abo Shaara,(2009)	1.92	2.21
W. of basitarsus mm.	0.9 - 1.1	1.06 ± 0.0094	1.10	Abo Shaara,(2009)	1.06	1.09
L. of hind leg mm.	(6.62 - 7.77)	7.26 ± 0.0345	7.39	Shaibi et al.,(2009)	-	-
L. of forewing (mm)	(8.2 - 8.8)	8.46 ± 0.0195	8.23 and 8.74	Abo Shaara,(2009)	8.14	8.36
W. of forewing (mm)	(2.7 - 3.05)	2.93 ± 0.0123	2.78-2.96	Abo Shaara,(2009)	2.76	2.84
L. of hindwing (mm.)	(5.8 - 6.4)	6.12 ± 0.0262	6.11	Abo Shaara,(2009)	-	-
W. of hindwing (mm.)	(1.7 - 1.9)	1.83 ± 0.0057	1.76	Abo Shaara,(2009)	-	-
numbers of hamuli	(19- 25)	22.33 ± 0.1614	20.34	Abo Shaara,(2009)	20.48	21.1
cubtal index	(1.7 - 2.97)	2.29 ± 0.0281	2.33 and 2.94	Abo Shaara,(2009)	2.61	2.46
L. of first wax mirror (mm.)	(1.20- 1.40)	1.35 ± 0.0063	1.11	Shaibi et al.,(2009)	1.35	1.3
W. of first wax mirror (mm.)	(1.9 -2.4)	2.12 ± 0.0162	-	-----	2.1	1.96
L. of third sternum (mm.)	(2.4 - 2.8)	2.60 ± 0.0201	-	-----	-	-
W. of third sternum (mm.)	(5.30 - 5.90)	5.67 ± 0.0079	-	-----	-	-

Lenght W width/ not detected* compiled from data of El-Seediet al(2023) (Review)** compiled from data of Hassanein and el Banby,(1956)(Egyptian bees reared in mud tube hives)*** compiled from data of Wafaetal ,(1962)(Egyptian bees reared in mud tube hives)

F. Wax mirror

The length and width of the first wax mirror were ranged from 1.20 to 1.40 mm. with average value of 1.35 ± 0.006 mm. and from 1.9 to 2.4 mm. with average value of 2.12 ± 0.0162 mm. respectively.

The length and width of the third sternum were ranged from 2.4 to 2.8 mm. with average value of 2.60 ± 0.020 mm. and from 5.30 to 5.90 mm. with average value of 5.67 ± 0.00793 mm. respectively.

comparable results were registered at Shebin El-Kom, (north Egypt) by El- Banby, (1954) Egyptian worker wax mirror length that registered by them was 1.35 ± 0.028 mm as average values. While the width of wax mirror was ranged from 2.10 ± 0.007 mm. as average values.

CONCLUSION

In 2023, this realization was undertaken at Al-Azhar University Faculty of Agricultural Science. The primary purpose of this study is to assess morphometric traits of *A.m. lamareckii* bees in the Assiut governorate region of Egypt. Based on the results of this research, it is concluded that contact with European races has not resulted in any significant changes in the morphological characteristics studied among Egyptian honeybees in the Assiut governorate. It is possible to consider the Egyptian honeybees in Assiut a race, but not a pure one. Wafaet al, (1962) speculate that Egyptian drones may be more likely to mate with virgin queens because they have a lighter weight, are able to fly faster, and reach a higher altitude than European drones. As an example, queens

produced locally from European races have progeny in which Egyptian characteristics are easily seen, and which become dominant in the second generation. Therefore the Apiculture scientist must work immediately and orientate their researches to preserve and purebred the Egyptian bee strain

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دراسات مورفومترية على نحل العسل المصري *Apis mellifera lamarckii*

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المخلص

الصفات المورفولوجية لشغالات نحل العسل هي من الصفات المهمة لبرنامج التربية والتحسين ومفيدة للتمييز بين السلالات والأنماط البيئية. تم إجراء هذه الدراسة في كلية الزراعة بجامعة الأزهر خلال موسم 2023. تم جمع شغالات نحل العسل من منحل يتم استخدام التربية التقليدية باستخدام الخلايا الطينية بمحاكاة أسبوط في مصر لدراسة بعض الصفات المورفولوجية كطول الخرطوم، طول السوط، الطول الكلي لقرون الاستشعار، طول عرض الرأس، طول الجناح الأمامي وعرضه، طول الجناح الخلفي وعرضه، عدد الخطافات، طول عظم الفخذ، عرض وطول الساق، طول وعرض أول عقلة من الرسغ، طول وعرض الساق الخلفية، طول وعرض غدة الشمع الأولى. تم وضع جميع عينات الشغالات في الثلاجة -20 درجة مئوية في المختبر حتى تحليلها. أظهرت النتائج أن القيم المتوسطة هي: طول اللسان 5.69 ملم، طول الجناح الأمامي 8.46 ملم، والعرض 2.93 ملم. عدد الخطافات على الجناح الخلفي 22.33؛ طول غدة الشمع الأولى 1.35 ملم والعرض 2.12 ملم. هذه الصفات يمكن استخدامها للإشارة إلى الأصل المصري في النحل الهجين ويمكن اعتبار نحل العسل المصري في أسبوط سلالة غير نقية إلى حد ما.

الكلمات الدالة: سلالة النحل المصري – الصفات المورفولوجية – طول الجناح الأمامي – طول اللسان