

MORPHOMETRIC DIFFERENCES BETWEEN CERTAIN HONEYBEE HYBRIDS *APIS MELLIFERA* REARED IN EGYPT

KHATTABY, A.M.¹, YOUSIF-KHALIL, S. I.², MEGAHID E.² AND A.M. KHATER¹

¹ Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza. EGYPT.

² Plant Protection Department, Faculty of Agriculture, Zagazig University.

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Abstract

The morphometric characters of worker honeybee of the 1st hybrid of Carniolan, Caucasian and Italian races were studied in 1993-1996. These characters were the following:

Flagellum length, proboscis length, forewing (length-width-cubital index), hind wing (length-width-no. of hamuli), 1st basitarsus (length-width), hind leg (femur length-length and width of the tibia-area of pollen basket-area of basitarsus), length and width of 1st wax mirrors - length and width of 4th abdominal sternite and acid gland (length percentage of splittig -size of poison sac).

Carniolan hybrid was the best.

Key Words Morphometric, *Apis mellifera*, hybrids, F₁ Carniolan F₁ Caucasian F₁ Italian

INTRODUCTION

The morphometric measurements in honeybee *Apis mellifera* L. are affected by different factors including bee race Aly *et al.* 1989 and (Atallah *et al.* 1989), locality (El-Kashef 1959), cell size (Khattaby 1981) and colony strength (Bilash 1977), but not affected by the time of the year or age (Gromisz 1978). Leporati *et al.* (1983) distinguished between bee races according to these characters (measurements). There are direct correlations between these dimensions and bee production (Romaniuk *et al.* 1993). This investigation aims to study certain morphometric measurements of the honey bee *Apis mellifera* L. F₁ hybrids of the Carniolan, Caucasian and Italian races in the Egyptian environment to recommend the best race for beekeepers.

MATERIALS AND METHODS

Work was carried out in (1993-1996). Experiments were performed in a private apiary at El- Moullak district, Abou-Hammad district, Sharkia Governorate, and the Research Laboratories of Plant Protection Department, Faculty of Agriculture, Zagazig university.

Experimental honeybee colonies: A total of 15 honeybee nuclei were selected in June 1993 and divided into 3 groups of 5 nuclei each. A mated young queen was introduced into each nucleus as follows: group A nuclei (F_1 Carniolan): The 5 introduced sister queens of 1st hybrid Carniolan (*Apis mellifera carnica*) resulted from open mating of a virgin queen reared from the progeny of localized Carniolan mother (brought from El-Manzalah district. Group B nuclei (F_1 Caucasian): The 5 introduced sister queens were of first hybrid of the Caucasian (*A.m. caucasica*) obtained by open mating of virgins reared from the progeny of an imported Caucasian mother. Group C nuclei :5 nuclei were selected in March 1993, and provided with 5 sister queens of the 1st Italian hybrid (*A.m. ligustica*), resulted from open mating of virgins reared from the progeny of an imported Italian mother. Open mating of virgin queens in the three groups was conducted at El-Moullak district using mating baby nuclei. All nuclei were equalized as far as possible in strength, percentage infestation of varroa, number of combs covered with bees, brood, stored honey and bee bread.

a- Sampling method: A sample of 25 honeybee workers of 21 days old were taken from each experimental colony for morphometric studies. Bees were marked with colour paint upon emergence to be easily distinguished. Bees were then killed in boiling water to ensure full extension of the proboscis (tongue) and preserved in Pompell's fixative (equal parts v/v) of rectified ethyl alcohol, glycerin and distilled water.

b. Morphometrical measurements: Certain appendages mainly: tongue (proboscis), right antenna, forewing, hind wing, sternite IV, acid gland and its poison sac were dissected from each individual honeybee worker. Dissected parts were then mounted on slides using Balsam Canada. All linear parameters were measured by a micrometer with the aid of stereo binocular. Maximum measurements were recorded for total tongue (proboscis) length, mandible length, length of flagellum, forewing (length, width and cubital index), hind wing (length, width and the number of hamuli (hooks), 1st basitarsus and hind leg (length of femur and tibia, surface area of tibia and area of basitarsus).

RESULTS AND DISCUSSION

Antenna: Table 1 shows that the mean length of flagellum of worker's antenna was 3.004, 2.993 and 3.019 mm for Carniolan, Caucasian and Italian hybrids, respectively.

Proboscis and mandible: The mean length of proboscis was 5.758, 6.272 and 6.033 mm., while the mean lengths and widths of mandible were (1.352, 0.650), (1.312, 0.561) and (1.312, 0.540) mm. for Carniolan, Caucasian and Italian hybrids, respectively, Table 1. In this respect, El-Banby (1968) reported comparatively longer mean tongue lengths (6.38 mm. for Carniolan workers), whereas, Aly *et al.* (1989) found that the mean length of proboscis was 6.21, 6.08 and 5.41 mm. for Carniolan, Italian and Egyptian workers, respectively. Atallah *et al.* (1989) showed similarity in the length of proboscis in Carniolan and Italian workers.

Forewing: Data in Table 1 show that the mean length and width of forewing was (9.031, 3.086), (9.073, 3.03) and (9.148, 2.95) mm. for Carniolan, Caucasian and Italian workers, respectively. In addition, the respective cubital indices of the three hybrids were 2.41, 2.616 and 2.79 mm. Similar results were obtained by El-banby (1968). Edris (1997) Stated that the mean length of forewing of Carniolan workers ranged 8.90-9.06 mm. and Atallah *et al.* (1989) reported similarity in forewing length for Carniolan and Italian workers.

Hind wing: As seen in Table 1, the mean length and width of the hind wing were 6.485, 1.801, 6.441, 1.782 and 6.452, 1.676 mm. for Carniolan, Caucasian and Italian hybrids, respectively. Corresponding respective mean numbers of hamuli (hooks) on hind wing were 21.6, 19.933 and 23.133 hooks.

Hind leg: Table 1 gives the mean length of hind femur which measured 2.640, 2.598 and 2.594 mm for Carniolan, Caucasian and Italian workers, respectively. The corresponding respective means of the length and width of hind tibia were (3.112, 1.081), (3.042, 1.065) and (3.067, 1.057) mm. The mean surface area of corbicula recorded 1.683, 1.623 and 1.621 mm² for Carniolan, Caucasian and Italian hybrids, respectively. Such measurements agree with Aly *et al.* (1989) who reported a corbicular areas of 1.63 and 1.62 mm² for Carniolan and Italian races reared in Egypt. However, higher figures were obtained by Milne *et al* (1986) (corbicular areas of 1.909 and 1.874 mm² for high pollen and low pollen hoarding lines, respectively). Atallah *et al* (1989) mentioned similarity in corbicular area for Carniolan and Italian honeybee workers. The mean length and width of the hind basitarsus were (2.183, 1.126), (2.130, 1.115) and (2.101, 1.111) mm for F1 Carniolan, F1 Caucasian and F1 Italian workers, respectively.

The corresponding calculated mean surface area of hind basitarsus were 2.458, 2.376 and 2.333 mm². The mean number of hair rows on the hind basitarsus reached 9.067, 9.333 and 9. rows for Carniolan, Caucasian and Italian hybrids, respectively.

The fourth sternite and 1st wax mirrors: The mean length and width of the first wax mirror on the fourth abdominal sternite was (1.519, 2.631), (1.50, 2.324) and (1.496, 2.260) mm for Carniolan, Caucasian and Italian workers, respectively. The corresponding mean lengths of the distance between the two mirrors were 0.179, 0.252 and 0.278 mm. The mean length and width of the 4th sternite were 2.647, 5.165-2.611, 5.106 and 2.289, 5.040 mm for Carniolan, Caucasian and Italian hybrid workers, respectively, Table 1. In this respect, Khattaby (1981) found that the mean length and width of 1st wax mirror was 1.46 and 2.13 mm for F1 Carniolan workers, respectively. Variations could be attributed to the varied races and prevailing biotic and abiotic factors.

The acid gland: Table 1 shows the mean length of acid gland which measured 16.087, 12.840 and 14.513 mm for Carniolan, Caucasian and Italian hybrid workers, respectively. The respective mean percentages of splitting (bifurcation) of the distal part of the acid gland reached 67.667, 80 and 93.

Table 1. Mean measurements of certain morphometric characters of worker honeybees of three hybrids F₁ Carniolan, F₁ Caucasian and F₁ Italian (in mm).

Bee characters	F ₁	F ₁	F ₁	LSD		F ₁		
	Carniolan	Caucasin	Italian	5%	1%	Car.	Cua.	It.
Flagellum length	3.004	2.993	3.019	0.025	0.023	a	a	b
Proboscis length	5.758	6.272	6.033	0.162	0.268	c	a	b
Mandible length	1.325	1.312	1.312	0.012	0.020	b	a	a
Mandible width	0.650	0.561	0.540	0.018	0.024	a	b	c
Fore wing length	9.031	9.073	9.148	-	-			
Fore wing width	3.086	3.030	2.950	0.072	0.097	a	a	b
Fore cubital index	2.416	2.616	2.790	0.222	0.367	b	a	a
Hind wing length	6.485	6.441	6.452	-	-			
Hind wing width	1.801	1.782	1.676					
Hind no. of hamuli	21.60	19.93	23.13	1.752	2.740	a	a	b
Hind leg feamer length	2.640	2.698	2.694	0.033	0.044	b	a	a
Hind tibia length	3.112	3.042	3.064	0.040	0.063	a	b	b
Hind tibia width	1.081	1.065	1.057	0.010	0.014	a	b	b
(hind basitarsus) length	2.183	2.130	2.101	0.031	0.042	a	b	b
(hind basitarsus) width	1.126	1.115	1.111					
//surface area mm ²	2.458	2.376	2.333	0.069	0.080	a	b	b
// no. of rows hair	9.067	9.333	9.333					
4 sternite length	2.647	2.611	2.589					
// width	5.165	5.016	5.040	0.067	0.115	a	a	b
wax mirrors length	1.519	1.500	1.496					
// width	2.361	2.324	2.260	0.047	0.078	a	a	b
distance between mirrors	0.179	0.252	0.278	0.074	0.123	a	a	b
Acid gland length	16.087	12.840	14.513	0.973	1.614	b	a	a
// % splitting	67.667	80.000	93.333					

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الأختلافات المورفومترية بين بعض هجن نحل العسل المرباة فى مصر

أحمد محمود خطابى^١ ، سعد إبراهيم يوسف^٢ ،
السيد مجاهد^٢ ، على محمد خاطر^١

^١ معهد بحوث وقاية النباتات - مركز البحوث الزراعية-الدقى -الجيزة.

^٢ كلية الزراعة - جامعة الزقازيق - الزقازيق - مصر

درست بعض الصفات المورفومترية لشغالات نحل العسل من الهجين الأول للسلالات الكرنيولى و القوقازى و الأيطالى خلال المدة من ١٩٩٣ حتى ١٩٩٦ وأخذت فى الاعتبار الصفات الآتية :

طول الشمراخ ومتوسط طول الخرطوم ومتوسط طول وعرض الجناح الأمامى ومتوسط مؤشر الجناح ومتوسط طول وعرض الجناح الخلفى ومتوسط عدد الخطاطيف على الجناح الخلفى ومتوسط طول وعرض العقلة القاعدية لرسغ الرجل الأمامية ومن الخلفية (متوسط طول الفخذ ومتوسط طول وعرض الساق ومتوسط مساحة سلة اللقاح ومتوسط مساحة سطح العقلة القاعدية لرسغ الرجل الخلفية) ومتوسط طول وعرض مرايا الشمع الأولى على الحلقة البطنية الرابعة ومتوسط طول وعرض استرنة الحلقة البطنية الرابعة ومتوسط طول الغدة الحامضية والنسبية المثوية لتفرغ نهاية الغدة الحامضية وحجم مخزن السم.

وكان الهجين الأول الكرنيولى أفضل هذه السلالات.