

LONGIVETY AND DEVELOPMENT OF BODY WEIGHT AND HYPOPHARYNGEAL GLANDS OF WORKERS FROM HONEYBEE HYBRID OF DIFFERENT RACES IN EGYPT

YOUSIF-KHALIL, S.I.¹, A.M. KHATTABY², E. MOGAHID¹ AND A.M. KHATER²

¹ Plant Protection Department, Faculty of Agriculture, Zagazig University

² Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza Egypt.

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Abstract

The longevity and development of body weight and hypopharyngeal glands of honeybee workers of F₁ Carniolan F₁ Caucasian and F₁ Italian were studied during two successive winter seasons 1994/1995-1995/1996. Summarized data were as follows:

1- The LT₅₀ and LT₉₀ for the workers of F₁ Carniolan, F₁ Caucasian and F₁ Italian recorded (37.5, 58.5), (33.55, 53.89) and (31.78, 54.53), respectively.

2- The least body weight of honeybee workers of the three hybrids were recorded for the newly emerged workers. Then, it increased gradually until reached the heaviest weight on the 14th day of age recording 109.7, 114 and 106.7 mg. for F₁ Carniolan F₁ Caucasian and F₁ Italian, respectively. Thereafter, the weights started to decrease gradually. However, the highest weights were recorded for F₁ Caucasian workers.

3- Similarly, the least development of hypopharyngeal glands (length, width and surface area of the gland acinus) was recorded for newly emerged workers. Whereas the highest measures of the three parameters were recorded for 7 days old workers that followed by a noticeable reducing of the gland development on the 14th day before it increased again on the 21th day of workers age. However, F₁ Carniolan workers showed the highest gland development, whereas F₁ Caucasian ones manifested the least hybrid development in general. Carniolan hybrid was the best.

Key words: Longevity, body weight, hypopharyngeal glands, honeybee hybrids.

INTRODUCTION

Longevity, body weight and hypopharyngeal glands are important criteria in breeding and selection of honeybees for high productivity of honey, bee bread, brood rearing and royal jelly (Fluri 1990). Since such criteria are negatively correlated with varroa infestation, race degradation and pesticidal bee intoxication. They may identify reduction in bee products and discriminate races hybrids. (Yousif-khalil, 1992) and (Fermiano and Stort, 1985). The aim of this investigation is to study the longevity,

body weight and hypopharyngeal glands worker honeybee in F_1 Carniolan, F_1 Caucasian and F_1 Italian hybrids.

MATERIALS AND METHODS

Work was carried out in a private apiary located at EL-Moullak, Abou-Hammad district, Sharkia Governorate and the Laboratories of Plant Protection Department, Faculty of Agriculture, Zagazig University during winter seasons of 1993/1994-1995/1996.

Experimental honeybee colonies: A total of 15 honeybee nuclei were initiated during June 1993 by division of strong colonies. These nuclei were 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 introduced five sister queens of the 1st hybrid Carniolan (*Apis mellifera carnica*), resulting from open mating of virgin queens reared from the progeny of localized Carniolan mother (brought from El-Manzalah district) were introduced to the colonies.

Group B nuclei (F_1 Caucasian): The introduced 5 sister queens were of the 1st Caucasian (*A.m.caucasica*) hybrid obtained by open mating of virgins reared from the progeny of an imported Caucasian mother.

Group C nuclei (F_1 Italian): Five nuclei were initiated during March 1993, and provided with 5 sister queens of the 1st Italian (*A.m.ligustica*) hybrid resulted from open mating of virgins reared from the progeny of an imported Italian mother.

All nuclei were equalized as far as possible in strength, percentage of varroa infestation, number of combs covered with bees, brood, and stored food.

a. Longevity of workers: To study the longevity of workers of F_1 Carniolan, F_1 Caucasian and F_1 Italian hybrids, Yousef-Khalil (1992) method was applied. Sealed brood combs ready to emerge were taken from each experimental colony without bees and caged individually in complete comb cage in the original colony. Twelve hours later, cages were taken out and > 150 emerging workers were marked with color paint on the comb, then released immediately in their colonies. Smoking was simultaneously practiced to reduce bee attacks. Five days later, marked bees were counted and recorded as initial number. The entrance of every test colony was plugged with green

grasses at sunset a day before counting. Combs were successively inspected then marked workers were counted after the inspection of all combs and inner walls of the hive. Counting was practiced at 5 days interval until all marked bees died.

b. Progress of workers body weight: This part of the study was performed during the winter season of 1994/1995.

To study the progress in worker body weight, the same procedure applied for longevity of worker was followed. Samples of 25 marked workers 0,7,14 and 21 days old were picked up from every colony, anaesthetized by chilling, then quickly weighed individually.

c. Development of hypopharyngeal glands: The same procedure used to obtain newly emerged workers for longevity and weight studies was also applied during 1993/1994 and 1994/1995 winter seasons. About 150 newly emerged workers were marked and returned to their colonies. Workers of 0,7,14, and 21 days age were picked out for dissection. Thirty workers were taken to represent each treatment (10 workers/colony/age). The glands were dissected out and the length and width of 20 acini were measured for each worker under the stereomicroscope using an ocular micrometer. Acinal surface area of gland acini was calculated according to Maurizio's formula (1954);

Acinal surface = $11 \times (a \times b) / 2$ where: $11=3.14$, a = maximum length of acini and b = maximum width of acini.

RESULTS AND DISCUSSION

a. Longevity of workers: Table 1 shows that the mean longevity of workers in winter was 78,73 and 77 days for F₁ Carniolan, F₁ Caucasian and F₁ Italian hybrids, respectively. The respective L50 were 37.5, 33.55 and 31.78 days and L90 58.5 days for F₁ Carniolan workers, 53.89 days for F₁ Caucasian workers and 54.0 days for F₁ Italian workers. These results agree with Fluri (1990) and Yousif-Khalil (1992). Reduction in workers longevity inversely affects honey production, collection of pollen, wintering and brood rearing, Wille *et al.* (1985).

b. Workers body weight: Table 2 shows that the mean body weight of newly emerged workers of F₁ Carniolan, F₁ Caucasian and F₁ Italian hybrids was 94.7, 96.7 and 93.0 mg., respectively. The corresponding weights of 7 days old workers reached 101.3, 107.3 and 93 mg. Moreover, the heaviest body weights were recorded for 14

days old workers (109.7, 114.0 and 106.7mg. for the three hybrids, respectively). Thereafter, body weight decreased to means of (96.7, 98.6 and 94.7 mg.) for 21 days old workers of the three hybrids, respectively. Such result coincides with Yousef-Khalil (1992). The wide range of workers body weight recorded in the present work may be attributed to differences in size of worker cells (Kattaby 1981), rate and intensity of varroa mite infestation (Yousif Khalil, 1992 and Mattar, 1996), the degree of fillness of honey sac (Gromisz and Villumsted, 1974), season of the year (Dianov, 1977) and races of bee (El-Banby and Abou-Korah, 1975).

c. Development of the hypopharyngeal glands

- **Mean acinal length:** The mean acinal length of the hypopharyngeal gland was 0.0951, 0.1328, 0.1223 and 0.1298 mm. for newly emerged workers; 0.2106 and 0.2214 mm. for 7 days old workers; 0.1886, 0.1629 and 0.1798 mm. for 14 days old workers and 0.2074, 0.1782 and 0.2087 mm. for 21 days old workers of the F₁ Carniolan, F₁ Caucasian and F₁ Italian hybrids, respectively, Table 3.

- **Mean acinal width:** The mean acinal width of the hypopharyngeal gland was 0.0954 and 0.0829 mm. for 1-day old workers; 0.1452, 0.1436 and 0.1446 mm. for 7 days old workers; 0.1084, 0.0906 and 0.0898 mm. for 14 days old workers and 0.1169, 0.0980 and 0.1143 mm. for 21 days old workers of the F₁ Carniolan, F₁ Caucasian and F₁ Italian hybrids, respectively, Table 3.

- **Mean acinal surface area:** As shown in Table 2, the calculated surface area of the hypopharyngeal gland acinus recorded 0.0199, 0.0188 and 0.169 mm² for newly emerged workers; 0.0564, 0.0475 and 0.0503 mm² for 7 days old workers; 0.0321, 0.0237 and 0.0255 mm² for 14-days old workers, and 0.0381, 0.0276 and 0.0375 mm² for 21 days old workers of F₁ Carniolan, F₁ Caucasian and F₁ Italian hybrids, respectively. Results refer that for the three tested hybrids, the gland acinus increased gradually in length, width and surface area, since the first day after emergence until they reached the maximal measurements on the 7th day of their life. However, F₁ Carniolan workers showed the highest gland development, whereas F₁ Caucasian ones showed the least hypopharyngeal gland development. As the workers became older, a gradual decrease was noticed in gland development until it reached a minimum by 14th day of the workers life for all hybrids. Results suggest the observation that the gland showed another increase in its acinal measurements. The hypopharyngeal gland manifested two peaks of development, one nearly by the middle of the nursing period (6-9 days), and the other by the end of nursing occupation. This pattern of the hypopharyn-

geal gland development was also reported by Takenaka *et al.* (1990) who stated that the worker hypopharyngeal gland has two separate phases of secretion; first it produces larval food, then enzymes for honey elaboration. The relatively more developed hypopharyngeal gland in F₁ Caucasian workers may be attributed to heredity, higher adaptation, higher protein content in haemolymph and higher quantity of stored pollen due to the more developed pollen basket. Variation between the different honeybee hybrids in hypopharyngeal gland development was reported by Abd-Alla (1997).

HONEYBEE	HYPOPHARYNGEAL GLAND DEVELOPMENT (mm)									
	1	2	3	4	5	6	7	8	9	10
Italian	1.47	1.33	1.55	1.38	1.61	1.42	1.68	1.46	1.63	1.49
Italian	1.59	1.41	1.66	1.48	1.71	1.52	1.76	1.56	1.73	1.58
Caucasian	1.31	1.17	1.34	1.19	1.38	1.23	1.42	1.27	1.45	1.30
F ₁ Hybrid	1.42	1.28	1.45	1.30	1.49	1.34	1.53	1.38	1.56	1.41
F ₂ Hybrid	1.45	1.31	1.48	1.33	1.51	1.36	1.54	1.39	1.57	1.42
F ₃ Hybrid	1.48	1.34	1.51	1.36	1.54	1.39	1.57	1.42	1.59	1.44
F ₄ Hybrid	1.51	1.37	1.54	1.39	1.57	1.41	1.60	1.43	1.62	1.46
F ₅ Hybrid	1.54	1.40	1.57	1.42	1.60	1.44	1.63	1.46	1.65	1.48
F ₆ Hybrid	1.57	1.43	1.60	1.45	1.63	1.47	1.66	1.49	1.68	1.50
F ₇ Hybrid	1.60	1.46	1.63	1.48	1.66	1.50	1.69	1.51	1.71	1.52
F ₈ Hybrid	1.63	1.49	1.66	1.51	1.69	1.52	1.72	1.53	1.74	1.54
F ₉ Hybrid	1.66	1.52	1.69	1.54	1.72	1.55	1.75	1.56	1.77	1.55
F ₁₀ Hybrid	1.69	1.55	1.72	1.57	1.75	1.58	1.78	1.59	1.80	1.58
F ₁₁ Hybrid	1.72	1.58	1.75	1.60	1.78	1.61	1.81	1.62	1.83	1.61
F ₁₂ Hybrid	1.75	1.61	1.78	1.63	1.81	1.64	1.84	1.65	1.86	1.64
F ₁₃ Hybrid	1.78	1.64	1.81	1.66	1.84	1.67	1.87	1.68	1.89	1.67
F ₁₄ Hybrid	1.81	1.67	1.84	1.69	1.87	1.70	1.90	1.71	1.92	1.70
F ₁₅ Hybrid	1.84	1.70	1.87	1.72	1.90	1.73	1.93	1.74	1.95	1.73
F ₁₆ Hybrid	1.87	1.73	1.90	1.75	1.93	1.76	1.96	1.77	1.98	1.76
F ₁₇ Hybrid	1.90	1.76	1.93	1.78	1.96	1.79	1.99	1.80	2.01	1.79
F ₁₈ Hybrid	1.93	1.79	1.96	1.81	1.99	1.82	2.02	1.83	2.04	1.82
F ₁₉ Hybrid	1.96	1.82	1.99	1.84	2.02	1.85	2.05	1.86	2.07	1.85
F ₂₀ Hybrid	1.99	1.85	2.02	1.87	2.05	1.88	2.08	1.89	2.10	1.88
F ₂₁ Hybrid	2.02	1.88	2.05	1.90	2.08	1.91	2.11	1.92	2.13	1.91
F ₂₂ Hybrid	2.05	1.91	2.08	1.93	2.11	1.94	2.14	1.95	2.16	1.94
F ₂₃ Hybrid	2.08	1.94	2.11	1.96	2.14	1.97	2.17	1.98	2.19	1.97
F ₂₄ Hybrid	2.11	1.97	2.14	1.99	2.17	1.99	2.20	2.00	2.22	1.99
F ₂₅ Hybrid	2.14	2.00	2.17	2.02	2.20	2.03	2.23	2.04	2.25	2.03
F ₂₆ Hybrid	2.17	2.03	2.20	2.05	2.23	2.06	2.26	2.07	2.28	2.06
F ₂₇ Hybrid	2.20	2.06	2.23	2.08	2.26	2.09	2.29	2.10	2.31	2.09
F ₂₈ Hybrid	2.23	2.09	2.26	2.11	2.29	2.12	2.32	2.13	2.34	2.12
F ₂₉ Hybrid	2.26	2.12	2.29	2.14	2.32	2.15	2.35	2.16	2.37	2.15
F ₃₀ Hybrid	2.29	2.15	2.28	2.17	2.35	2.18	2.38	2.19	2.40	2.18
F ₃₁ Hybrid	2.32	2.18	2.31	2.20	2.38	2.21	2.41	2.22	2.43	2.21
F ₃₂ Hybrid	2.35	2.21	2.34	2.23	2.41	2.24	2.44	2.25	2.46	2.24
F ₃₃ Hybrid	2.38	2.24	2.37	2.26	2.44	2.27	2.47	2.28	2.49	2.27
F ₃₄ Hybrid	2.41	2.27	2.40	2.29	2.47	2.30	2.50	2.31	2.52	2.30
F ₃₅ Hybrid	2.44	2.30	2.43	2.32	2.50	2.33	2.53	2.34	2.55	2.33
F ₃₆ Hybrid	2.47	2.33	2.46	2.35	2.53	2.36	2.56	2.37	2.58	2.36
F ₃₇ Hybrid	2.50	2.36	2.49	2.38	2.56	2.39	2.59	2.40	2.61	2.39
F ₃₈ Hybrid	2.53	2.39	2.52	2.41	2.59	2.42	2.62	2.43	2.64	2.42
F ₃₉ Hybrid	2.56	2.42	2.55	2.44	2.62	2.45	2.65	2.46	2.67	2.45
F ₄₀ Hybrid	2.59	2.45	2.58	2.47	2.65	2.48	2.68	2.49	2.70	2.48
F ₄₁ Hybrid	2.62	2.48	2.61	2.50	2.68	2.51	2.71	2.52	2.73	2.51
F ₄₂ Hybrid	2.65	2.51	2.64	2.53	2.71	2.54	2.74	2.55	2.76	2.54
F ₄₃ Hybrid	2.68	2.54	2.67	2.56	2.74	2.57	2.77	2.58	2.79	2.57
F ₄₄ Hybrid	2.71	2.57	2.70	2.59	2.77	2.60	2.80	2.61	2.82	2.60
F ₄₅ Hybrid	2.74	2.60	2.73	2.62	2.80	2.63	2.83	2.64	2.85	2.63
F ₄₆ Hybrid	2.77	2.63	2.76	2.65	2.83	2.66	2.86	2.67	2.88	2.66
F ₄₇ Hybrid	2.80	2.66	2.79	2.68	2.86	2.69	2.89	2.70	2.91	2.69
F ₄₈ Hybrid	2.83	2.69	2.82	2.71	2.89	2.72	2.92	2.73	2.94	2.72
F ₄₉ Hybrid	2.86	2.72	2.85	2.74	2.92	2.75	2.95	2.76	2.97	2.75
F ₅₀ Hybrid	2.89	2.75	2.88	2.77	2.95	2.78	2.98	2.79	3.00	2.78
F ₅₁ Hybrid	2.92	2.78	2.91	2.80	2.98	2.81	3.01	2.82	3.03	2.81
F ₅₂ Hybrid	2.95	2.81	2.94	2.83	3.01	2.84	3.04	2.85	3.06	2.84
F ₅₃ Hybrid	2.98	2.84	2.97	2.86	3.04	2.87	3.07	2.88	3.09	2.87
F ₅₄ Hybrid	3.01	2.87	3.00	2.89	3.07	2.90	3.10	2.91	3.12	2.90
F ₅₅ Hybrid	3.04	2.90	3.03	2.92	3.10	2.93	3.13	2.94	3.15	2.93
F ₅₆ Hybrid	3.07	2.93	3.06	2.95	3.13	2.96	3.16	2.97	3.18	2.96
F ₅₇ Hybrid	3.10	2.96	3.09	2.98	3.16	2.99	3.19	3.00	3.21	2.99
F ₅₈ Hybrid	3.13	2.99	3.12	3.01	3.19	3.02	3.22	3.03	3.24	3.02
F ₅₉ Hybrid	3.16	3.02	3.15	3.04	3.22	3.05	3.25	3.06	3.27	3.05
F ₆₀ Hybrid	3.19	3.05	3.18	3.07	3.25	3.08	3.28	3.09	3.30	3.08
F ₆₁ Hybrid	3.22	3.08	3.21	3.10	3.28	3.11	3.31	3.12	3.33	3.11
F ₆₂ Hybrid	3.25	3.11	3.24	3.13	3.31	3.14	3.34	3.15	3.36	3.14
F ₆₃ Hybrid	3.28	3.14	3.27	3.16	3.34	3.17	3.37	3.18	3.39	3.17
F ₆₄ Hybrid	3.31	3.17	3.30	3.19	3.37	3.20	3.40	3.21	3.42	3.20
F ₆₅ Hybrid	3.34	3.20	3.33	3.22	3.40	3.23	3.43	3.24	3.45	3.23
F ₆₆ Hybrid	3.37	3.23	3.36	3.25	3.43	3.26	3.46	3.27	3.48	3.26
F ₆₇ Hybrid	3.40	3.26	3.39	3.28	3.46	3.29	3.49	3.30	3.51	3.29
F ₆₈ Hybrid	3.43	3.29	3.42	3.31	3.49	3.32	3.52	3.33	3.54	3.32
F ₆₉ Hybrid	3.46	3.32	3.45	3.34	3.52	3.35	3.55	3.36	3.57	3.35
F ₇₀ Hybrid	3.49	3.35	3.48	3.37	3.55	3.38	3.58	3.39	3.60	3.38
F ₇₁ Hybrid	3.52	3.38	3.51	3.40	3.58	3.41	3.61	3.42	3.63	3.41
F ₇₂ Hybrid	3.55	3.41	3.54	3.43	3.61	3.44	3.64	3.45	3.66	3.44
F ₇₃ Hybrid	3.58	3.44	3.57	3.46	3.64	3.47	3.67	3.48	3.69	3.47
F ₇₄ Hybrid	3.61	3.47	3.60	3.49	3.67	3.50	3.70	3.51	3.72	3.50
F ₇₅ Hybrid	3.64	3.50	3.63	3.52	3.70	3.53	3.73	3.54	3.75	3.53
F ₇₆ Hybrid	3.67	3.53	3.66	3.55	3.73	3.56	3.76	3.57	3.78	3.56
F ₇₇ Hybrid	3.70	3.56	3.69	3.58	3.76	3.59	3.79	3.60	3.81	3.59
F ₇₈ Hybrid	3.73	3.59	3.72	3.61	3.79	3.62	3.82	3.63	3.84	3.62
F ₇₉ Hybrid	3.76	3.62	3.75	3.64	3.82	3.65	3.85	3.66	3.87	3.65
F ₈₀ Hybrid	3.79	3.65	3.78	3.67	3.85	3.68	3.88	3.69	3.90	3.68
F ₈₁ Hybrid	3.82	3.68	3.81	3.70	3.88	3.71	3.91	3.72	3.93	3.71
F ₈₂ Hybrid	3.85	3.71	3.84	3.73	3.91	3.74	3.94	3.75	3.96	3.74
F ₈₃ Hybrid	3.88	3.74	3.87	3.76	3.94	3.77	3.97	3.78	3.99	3.77
F ₈₄ Hybrid	3.91	3.77	3.90	3.79	3.97	3.80	4.00	3.81	4.02	3.80
F ₈₅ Hybrid	3.94	3.80	3.93	3.82	4.00	3.83	4.03	3.84	4.05	3.83
F ₈₆ Hybrid	3.97	3.83	3.96	3.85	4.03	3.86	4.06	3.87	4.08	3.86
F ₈₇ Hybrid	4.00	3.86	3.99	3.88	4.06	3.89	4.09	3.90	4.11	3.89
F ₈₈ Hybrid	4.03	3.89	4.02	3.91	4.09	3.92	4.12	3.93	4.14	3.92
F ₈₉ Hybrid	4.06	3.92	4.05	3.94	4.12	3.95	4.15	3.96	4.17	3.95
F ₉₀ Hybrid	4.09	3.95	4.08	3.97	4.15	3.98	4.18	3.99	4.20	3.98
F ₉₁ Hybrid	4.12	3.98	4.11	4.00	4.18	4.01	4.21	4.02	4.23	4.01
F ₉₂ Hybrid	4.15	4.01	4.14	4.03	4.21	4.04	4.24	4.05	4.26	4.04
F ₉₃ Hybrid	4.18	4.04	4.17	4.06	4.24	4.07	4.27	4.08	4.29	4.07
F ₉₄ Hybrid	4.21	4.07	4.20	4.09	4.27	4.10	4.30	4.11	4.32	4.10
F ₉₅ Hybrid	4.24	4.10	4.23	4.12	4.30	4.13	4.33	4.14	4.35	4.13
F ₉₆ Hybrid	4.27	4.13	4.26	4.15						

Table 1. Longevity of F₁ Carniolan , F₁ Caucasian and F₁ Italian workers under field conditions during the winter season of 1994/1995.

BEE HYBRID	Initial no of workers	Survival rate at respective ages (days)																	
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	LT50	LT90
F ₁ Carniolan	131	96.33	91.67	87.33	80.3	72.3	65.67	57	43.33	30.6	25	17	7	4	2.33	0.6	0	37.50	58.50
F ₁ Caucasian	125	94.67	90.33	85.67	3	3	57.33	47	36	7	14.67	8.67	3	2	0.33	0	-	33.55	53.89
F ₁ Italian	141	97.33	92.33	87.67	76.6	66.3	53.67	43.33	34	22.6	14.33	9.33	5	1.3	1.33	0.33	0	31.78	54

Bee	Workers body weight (mg) at respective ages (days) in F ₁ carniolan , F ₁ Caucasian and F ₁ Italian hybrids during the winter season of 1994/1995.		
	0	7	14
F1 Carniolan	94.7 (80-110)	101.3 (90-110)	109.7 (95-120)
F1 Caucasian	96.7 (85-120)	107.3 (90-120)	114 (100-135)
F1 Italian	93.0 (75-115)	98.0 (75-115)	106.7 (90-120)
LSD 0.05	1.9		
0.01	3.3		
MEANS OF BODY WIGHT			
F1 Carniolan	96.7 (85-110)		96.7 (85-110)
F1 Caucasian	93.0 (75-115)		94.7 (80-110)
F1 Italian	96.7 (85-120)		98.6 (85-120)
LSD 0.05	1.9		
0.01	3.3		
Worker age (days)			
F1 Carniolan	7	14	21
F1 Caucasian	7	14	21
F1 Italian	7	14	21

Table 2. Workers body weight (mg) at respective ages (days) in F₁ carniolan , F₁ Caucasian and F₁ Italian hybrids during the winter season of 1994/1995.

Table 3. The development of hypopharyngeal gland of worker in F₁ Carniolan, F₁ Caucasian and F₁ Italian hybrids.

Hybrids	workers age (days)		
	0		
	7	14	21
	Mean acinal length (mm)		
F ₁ Carniolan	0.1378 (0.1261-0.1387)	0.2473 (0.2345-0.2585)	0.1886 (0.1408-0.2310)
F ₁ Caucasian	0.1273 (0.1176-0.1296)	0.2106 (0.1859-0.2289)	0.1782 (0.1141-0.2063)
F ₁ Italian	0.1276 (0.1239-0.1338)	0.2214 (0.2148-0.2296)	0.1798 (0.1465-0.2190)
LSD 0.05	0.0064	0.0106	0.017
0.01	0.0106	0.018	0.028
	acinal width (mm)		
F ₁ Carniolan	0.0951 (0.0849-0.1056)	0.1452 (0.1296-0.1514)	0.1084 (0.0831-0.1268)
F ₁ Caucasian	0.0954 (0.0909-0.1007)	0.1436 (0.1253-0.1577)	0.0988 (0.0697-0.1190)
F ₁ Italian	0.0829 (0.0810-0.0866)	0.1446 (0.1401-0.1528)	0.1143 (0.0746-0.1268)
LSD 0.05	0.0073	-	0.0159
0.01	0.0121	-	0.0218
	acinal surface area (mm ²)		
F ₁ Carniolan	0.0199 (0.0177-0.0230)	0.0564 (0.0477-0.0614)	0.0321 (0.0184-0.0460)
F ₁ Caucasian	0.0183 (0.0168-0.0205)	0.0475 (0.0366-0.0567)	0.0276 (0.0125-0.0385)
F ₁ Italian	0.0169 (0.0158-0.0182)	0.0503 (0.0472-0.0551)	0.0255 (0.0172-0.0436)
LSD 0.05	0.0024	0.0059	0.0037
0.01	0.00402	0.0098	0.0062

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دراسات عن عمر الشغالة ووزن الجسم ونمو غدد الغذاء الملكي في بعض هجن نحل العسل المرباه في مصر *Apis mellifera L.*

سعد إبراهيم يوسف خليل^١، احمد محمود خطابي^٢،

السيد مجاهد^١، علي محمد خاطر^٢

١. كلية الزراعة - جامعة الزقازيق - الزقازيق - مصر.
 ٢. معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة.
- أجري البحث موسمي ٩٤ / ١٩٩٥ - ٩٥ / ١٩٩٦ لدراسة عمر شغالات نحل العسل ووزن أجسامها ونمو غدد الغذاء الملكي للهجين الأول للنحل الكرنبيولي والقوقازي والايطالي.
- كانت قيم LT90، LT50 لشغالات الهجين الأول الكرنبيولي والقوقازي والايطالي (٣٧.٥، ٥٨.٥)، (٣٣.٥٥، ٥٣.٨٩)، (٣١.٧٨، ٥٤.٥٣) علي الترتيب. وكان اقل وزن لشغالات الهجين الثلاثة للشغالات حديثة الخروج واثقل وزن في اليوم الرابع عشر (١٠.٩٠٧ و ١١٤ و ١٠٦.٧ ملجم) لهجين الكرنبيولي والقوقازي والايطالي علي الترتيب. ثم تناقص الوزن تدريجيا و بصفة عامة كانت شغالات الهجين القوقازي أثقل وزنا. كذلك وجد أن اقل تطور لغدد الغذاء الملكي (طول وعرض ومساحة فصوص الغدة) للشغالات حديثة الخروج ووصل نموها أقصاه في اليوم السابع من عمرها ثم تناقص النمو تدريجا حتي اليوم الرابع عشر وعاود الزيادة مرة أخرى حتي اليوم الحادي والعشرين من عمر الشغالة. وكان أعلا معدل نمو لغدد الغذاء الملكي في شغالات الهجين الأول الكرنبيولي وأدني معدل لها في شغالات الهجين الأول القوقازي.
- يتضح من الدراسة ان هجين اول الكرنبيولي افضل الهجين الثلاثة.