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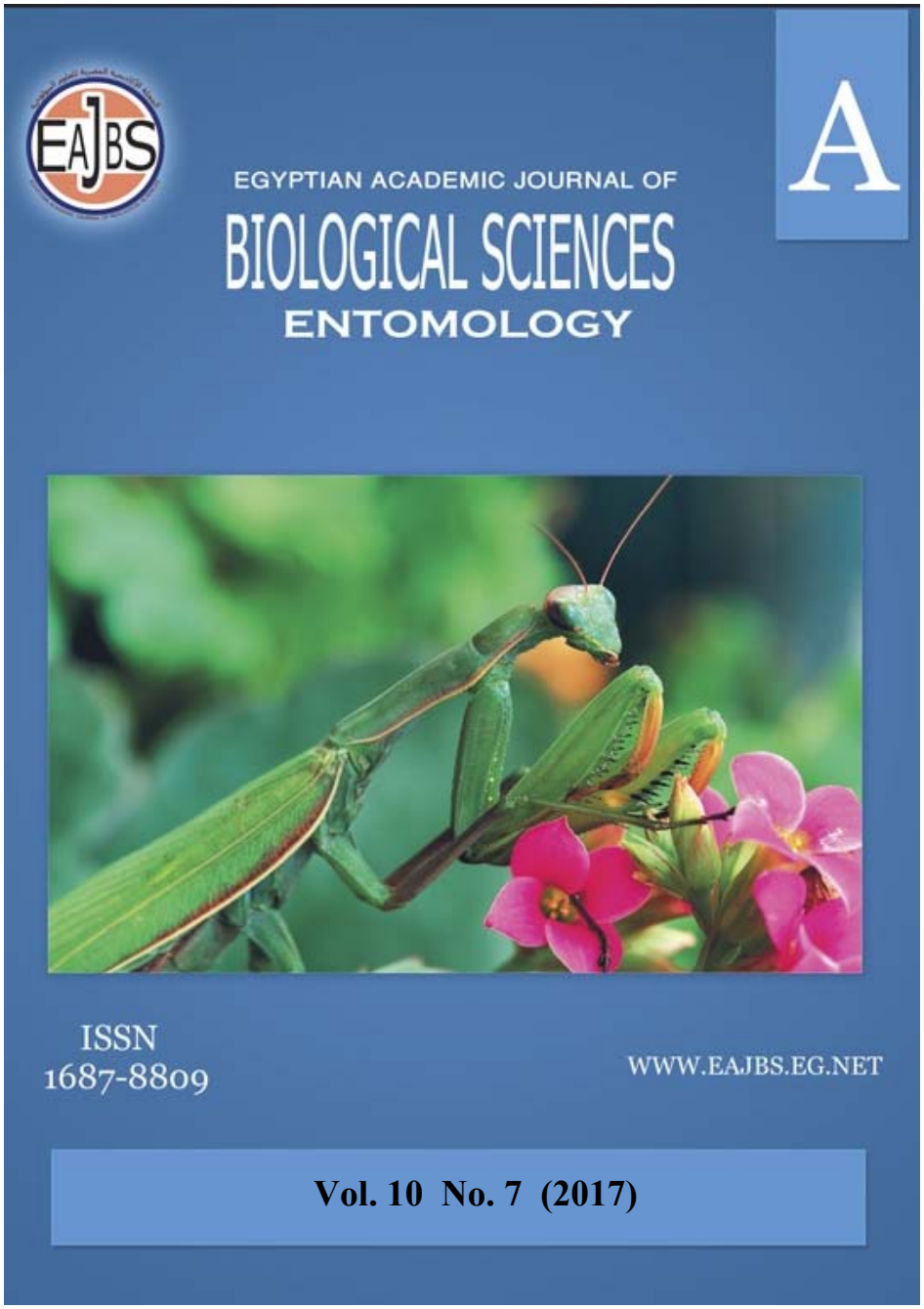

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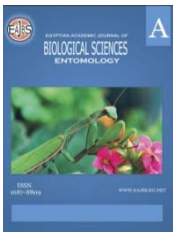

Effect of Feeding some Diets as A pollen Grains Supplements during Spring Season on Some Activities of Honey Bee Colonies

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ABSTRACT

This work was conducted in the apiary of Plant Protection Research Institute at El-Quanater, Qaluobia Governorate to study the effect of some diets on activities of honeybee colonies during spring season of 2016. It was compared to seven treatments on Carniolan hybrid bee colonies treatment (A) was (Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement plus sugar syrup (1:1), treatment (B) was sugar syrup (1:1) added with pollen grains, treatment (C) was (Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement plus sugar syrup (2:1), treatment (D) was sugar syrup (1:1) added with vitamin (Royal star), treatment (E) was El-Quanater fresh pollen cake plus sugar syrup (1:1), treatment (F) was (Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement plus sugar syrup (1:1) added with 1% Camphor oil (10ml / litter) and treatment (G) was pollen substitute cake consists of (sugar + protein + attractive material+vitamins) plus sugar syrup (2:1), by counting the daily worker brood rearing rate, the stored honey weight, the stored pollen weight and the longevity of newly emerged bee workers. Results revealed that the best diet was treatment (C). It came the first in order and produced a higher brood rearing rate was 968.84 worker brood/ day with increase percentages of 127.28% when compared to the corresponding average in the colonies before feeding. The average weight of stored honey was 3502.92 grams/ colony with increase percentages of 433.78% when compared to that before feeding. No significant differences were observed among the diets in the weight of stored pollen but treatment (C) produced a higher weight of stored pollen was 249.03 grams/ colony with increase percentages of 315.54% when compared to that before feeding and the average longevity of caged newly emerged worker was 26.17 days.

INTRODUCTION

Honey bees require protein, carbohydrates and water together with a wide range of micronutrients (Vitamins, minerals, enzymes) in order to produce a healthy colony. A correct artificial diet will improve the nutritional balance and the well-being of the colony. It is necessary to establish different nutritional strategies for different

regions, different categories of colonies and different colony products. The importance of pollen in the diet must not be underestimated, with the sowing of plant species that can maximize the nutritional quality of the colony. The brood rearing activity and nutritional state of the colony, the quantity and quality of incoming pollen grains, nectar and the food reserves in the colony will determine whether the bees need supplemental foods or not (Standifer *et al*., 1977 and El-Sherif *et al.,* 1994a). The greatest brood surface in the spring was recorded for the group additionally fed syrup with the vitamin-mineral preparation (Mladenovic *et al.,* 1999). The colonies fed with mung bean, wheat germ, soybean , yeast, and *Sativa vulgaris* showed worker brood areas of 31.66, 27.96, 20.21, 15.48 and 1.56 % more than the control ones (EL-Shaarawi, 2001).The soya bean flour, soya bean meal, wheat gluten and bread yeast can be used as pollen supplements (Abbasian and Ebadi, 2002). The colonies which fed on vitamin plus pollen grains, pollen grains and plain sugar syrup, their workers were hoarded 236, 220 and 191 mg of sugar syrup/3 days, respectively (Elbassiouny, 2006). The weight of newly emerged worker bees in pollen substitute-fed colonies was significantly more (1.89 g/20 bees) than those from control colonies (1.72 g/20 bees) (Sharma and Gupta, 2006). The best performance was in pea and pollen treatments; without any significant difference between them (Dastouri *et al*., 2007). The colonies fed with diet B=liquid yeast (*Candida tropicalis*) at 25% (1000g sugar + 250 ml liquid yeast + 750ml water); recorded the highest mean values of the number of combs covered with bees per colony and the mean longest life length of caged bees (32 days) was recorded by the liquid yeast (diet A) (*Candida tropicalis*) at 25% concentration, which represented 133.33% of the control (24 days) fed on sugar syrup (1:1) (Ashour *et al*., 2008a,b). The highest pollen substitute's consumption rate was recorded with coriander oil 0.03% (Alqarni and Alatawi, 2008). There are many studies regarding supplementary feeding of honey bee colonies with different formulae consisting of glucidic acid and vitaminic mixtures, but there are fewer studies made on the use of different plant extracts in supplementary feeding of bee colonies, especially in different stages of their biological development (Marghitas *et al*., 2010). Beekeepers often do not have much choice during periods of pollen dearth and feed their colonies any kind of pollen substitute or plain sugar aiming to produce highly rate of broods, stronger and healthy colonies (Atallah *et al*., 1979 and El-Banby and El-sherif, 1987a,b). Feeding colonies on either inadequate amount of natural pollen or inferior pollen grains substitute were both cause losses in bee colonies (Hussein, 1981, Lehnar, 1983 and Wahl and Ulm., 1983). Colonies fed on diets free from pollen did not rear brood to the sealed stage (Omar and Mateescu., 1985). Feeding colonies on extracts of certain medicinal plants have been mainly directed towards improving quality of the produced honey, as it had antimicrobial activity (Mishref *et al*., 1989) and contained antioxidants (Rosenblat *et al*., 1997). Less attention has been given to their effects on brood rearing rates and adult Longevity (Raj *et al*., 1993 and watanabe, 1993). Various types of Brewer's yeast have found extensive application in pollen substitute formulations. Its candy type-proved the most efficient method especially for workers production and longevity (Doull, 1973 and El-Banby and El-Sherif, 1987a,b). Sucrose syrup 66.6 or 50 % gave the best results for worker and drone production and longevity (El-Sherif and El-Banby, 1989; El-Sherif *et al*.,1994b). The brood area of honey bee (*Apis mellifera*) colonies fed weekly with in 2liter of sugar syrup fortified with isoleucine increased significantly more than in colonies fed sugar syrup only, when colonies were located in an area with adequate pollen sources, but did not do so in an area with poor pollen supplies. It also increased acceptance of grafted queen cells and cell production per colony, and decreased consumption of supplementary food

(Stace and White, 1994). The supplementary feeding on sunflower, agwa, or Yeast significantly increase brood areas compared to feeding on sugar syrup only. There was no obvious consistent preference between the three tested diets since the results varied with season (Mishref *et al*., 1995). Feeding colonies with 20% of the four medicinal plant extracts (Carob, *Ceratonia silique*; Tamarind*, Tamarindus indica;* Karkade*, Hibiscus sabdariffa and* Pepper-mint*, Mentha piperita)* mixed with sugar syrup significantly increased the brood rearing rates and the longevity of emerged workers in both Carniolan and hybrid colonies together (El-Sherif, 2002). Dearth periods are a critical problem for beekeeping; colonies dwindle and are inadequate for honey production and pollination services. Pollen substitutes can overcome a lack of natural food and reduce weakening and loss of colonies during critical periods. The feeding colonies with pollen substitute cake beside sugar syrup during spring and summer seasons stimulates of queens to lay more eggs and to workers encourages rear more brood. This significant increase in brood rearing reflects on a significant increase the colony population and pollen and honey production (Nabors, 2000 and Ghazala, 2006 and Ghazala and Nowar, 2013). The percentage of honey produced for the treatment pollen with yeast was found to be significantly better than that produced by the bees fed on pollen. The honey produced was about 25.7, 23.8, 21.4, 16.8 and 12.1 for chickpea with yeast, compressed date, maize flour with yeast and pollen, respectively when compared with those before feedings (Abusabbah *et al.*, 2012). The highest number of brood cells, the highest number of stored pollen cells and the heaviest pollen pellets gathered in the traps were recorded in hives of F1 Carniolan colonies supplied with pollen grain cake followed by yeast cake and soya bean cake (Ebrahim , 2013). The 5% protein ratio can be used in feed patties for feeding colonies in winter season (Devrim *et al.*, 2015). Protein supplementation is a key management tool to maintain the strength of bee colonies during period of pollen shortage. Adequate protein supplementation help maintain the health of the colonies (Moja *et al.*, 2015).

The aim of the present work is to study the effect of supplementary feeding on some activities of honeybee colonies for spring.

MATERIALS AND METHODS

This work was aimed at studying the effect of feeding the bee colonies by some diets of pollen supplement on brood rearing rates, amounts of stored honey, stored pollen and worker longevity. Twenty one honey bee colonies with relatively same strengths were used. Each contained 5 combs covered with bees (2 combs of sealed and unsealed brood, 2 combs of stored honey and pollen and one empty comb). The bee colonies were divided into 7 groups of treatments (diets). Each group consisted of three bee colonies (replicates), which introduced into Langstroth hives and received one of the following diet treatments at 3 days and week intervals:

Group (A): 50g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement (2 dried Brewer's yeast + 3 chick pea meal + 3 honey + 1 pollen + 15 sugar) + 250ml sugar syrup (1:1) / colony / 3 day intervals.

Group (B): 400ml sugar syrup (1sugar:1water) +10g pollen grains / colony / 3 day intervals.

Group (C): 375ml sugar syrup (2:1) /colony / 3 day intervals + 100g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement / colony/ week .

Group (D): 250ml sugar syrup (1:1) + 1cm vitamin (Royal star) /colony/ 3 day intervals.

Group (E): 50g El-Quanater fresh pollen cake (1kg El-Quanater fresh clover pollen pellets + 350ml honey) + 250ml sugar syrup /colony / 3 day intervals.

Group (F): 250ml sugar syrup (1:1) added with 1% Camphor oil (10ml / litter) / colony / 3 day intervals + 100g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement / colony/ week .

Group (G): 100gm pollen substitute cake 1 * + 500ml sugar syrup (2:1)/ colony/ week.

*N.B. pollen substitute cake 1 consists of (sugar + protein + attractive material + Vitamins).

Evaluation the experiment:

Daily brood rearing rate:

Areas of sealed brood cells were measured in square inches at 13 day intervals before and after feeding till the end of each experiment. At every inspection for each colony the daily number of brood rearing cells was calculated by (area of brood in square inches x 25/13).

The stored honey weight:

Areas of stored honey cells were measured in square inches at 13 day intervals before and after feeding till the end of each experiment. At every inspection for each colony the weight of stored honey was calculated by (area of honey cells in square inches x 25 x 0.35g honey/ cell).

The stored pollen grains weight:

Areas of stored pollen cells were measured in square inches at 13 day intervals before and after feeding till the end of each experiment. At every inspection for each colony the weight of stored pollen was calculated by (area of stored pollen cells in square inches x 25 x 0.062g pollen/ cell).

The longevity of newly emerged worker bees:

Collecting the newly emerged worker bees from each experimental colony. The cages of bees were provided with sugar syrup (1:1). Daily inspection carried out to count died bees in each cage till all bees died, and then calculating the average life length of worker bees for each cage at the end of the test by the following equation:

Average of worker longevity = Σ(daily No. of dead bees x its longevity) / total No. of caged bees

Statistical analysis:

The F-test was applied for analysis of variance and the L.S.D with level of 0.05 was used to determine significance of differences among the means.

RESULTS AND DISCUSSION

Daily brood rearing rate

The results in Table (1) and Fig. (1) show that, feeding the honeybee colonies on treatment (C) at 3 day intervals for two months of spring season (15/2 – 20/4/2016) produced more broods with a higher brood rearing rate than the other treatments in the experiment. This may be due to the increase of both amount and concentration of sugar syrup introduced to the colonies at 3 day intervals. The data in table (1) also show that, the feeding of honeybee colonies on treatments (C), (A), (E), (G), (F), (B) and (D), respectively significantly increased brood rearing rates (No. of cells), averaged 968.84, 918.08, 913.21, 859.62, 821.02, 786.54 and 707.18 worker broods/ day with increase percentages of 127.28, 61.28, 74.79, 94.35, 79.13, 88.77 and 66.69% respectively, when compared to the corresponding averages in the colonies before feeding on sugar syrup only.

Table (1): Average daily worker brood rearing rates (No. of cells) before and after feeding honeybee colonies on different diets during spring season of 2016, and their relationships.

Periods	Diets (A)	(B)	(C)	(D)	(E)	(F)	(G)	F value	L.S.D.
Before feeding									
15/2 a	569.23 ± 71.46	416.67 ± 17.84	426.28 ± 17.85	403.85 ± 86.18	522.44 ± 44.87	458.33 ± 21.02	442.31 ± 22.20	insign	.....
After feeding									
28/2 b	850.00 ± 89.46	676.28 ± 76.59	655.13 ± 54.01	564.74 ± 28.96	753.21 ± 25.66	643.59 ± 96.23	671.79 ± 55.53	insign	.....
12/3 c	852.56 ± 87.13	705.13 ± 97.76	849.36 ± 89.23	714.74 ± 86.78	837.18 ± 80.08	778.85 ± 75.09	793.59 ± 75.52	insign	.....
25/3 d	900.64 ± 72.45	839.75 ± 94.43	1044.87 ± 93.94	737.18 ± 61.90	1003.21 ± 118.59	881.41 ± 108.55	865.38 ± 66.62	insign	.....
7/4 e	967.95^{ab} ± 83.33	852.57^{bc} ± 99.51	1141.02^{a} ± 64.82	750.00^{c} ± 52.96	985.26^{ab} ± 34.51	880.13^{bc} ± 61.28	967.95^{ab} ± 63.13	4.45	180.09
20 /4 f	1019.23^{ab} ± 72.81	858.97^{bc} ± 73.93	1153.85^{a} ± 58.49	769.23^{c} ± 88.83	987.18^{ab} ± 94.59	921.15^{bc} ± 40.54	999.36^{ab} ± 64.57	4.49	179.49
General Mean (rates No. of cells) g	918.08^{ab} ± 3.13	786.54^{bc} ± 39.51	968.84^{a} ± 95.48	707.18^{c} ± 36.69	913.21^{ab} ± 50.07	821.02^{abc} ± 50.21	859.62^{abc} ± 59.55	3.42	165.12
Relationships as %Increase or decrease									
(b-a)/a	49.32	62.31	53.68	39.84	44.17	40.42	51.88		
(c-a)/a	49.77	69.23	99.25	76.98	60.24	69.93	79.42		
(d-a)/a	58.22	101.54	145.11	82.54	92.02	92.31	95.65		
(e-a)/a	70.04	104.61	167.67	85.71	88.59	92.03	118.84		
(f-a)/a	79.05	106.15	170.68	90.47	88.96	100.98	125.94		
(g-a)/a	61.28	88.77	127.28	66.69	74.79	79.13	94.35		

Where:

Group (A): 50g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement (2 dried brewer's yeast + 3 chick pea meal + 3 honey +1 pollen +15 sugar) +250ml sugar syrup (1:1) / colony / 3 day intervals.

Group (B): 400ml sugar syrup (1:1) +10g pollen grains /colony/3day intervals .

Group (C): 375ml sugar syrup (2:1) /colony / 3day intervals + 100g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement (2 dried brewer's yeast + 3 chick pea meal + 3 honey +1 pollen +15 sugar)/colony/week intervals.

Group (D): 250ml sugar syrup (1:1) +1cm vitamin (Royal star) /colony/3day intervals

Group (E): 50g El-Quanater fresh pollen cake (1kg El-Quanater fresh clover pollen pellets + 350ml honey) + 250ml sugar syrup /colony / 3day intervals.

Group (F): 250ml sugar syrup (1:1) added with 10ml Camphor oil / litter of syrup / colony / 3 day intervals + 100g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement (2 dried brewer's yeast + 3 chick pea meal + 3 honey +1 pollen +15 sugar)/colony/week intervals.

Group (G): 100g pollen substitute cake 1 (sugar + protein + attractive material + Vitamins).+ 500ml sugar syrup (2:1)/colony/week/intervals.

a: before feeding.
b-f: after feeding.
g: general mean after feeding

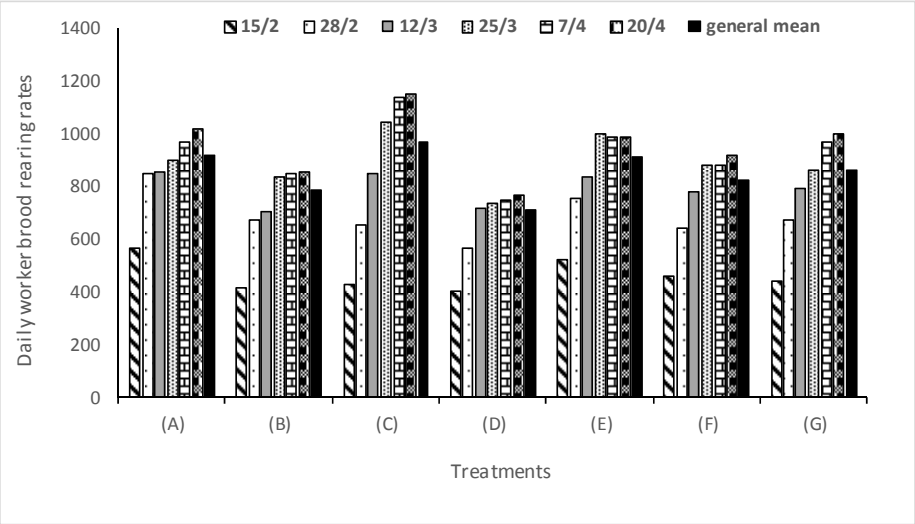

Fig. (1): Average daily worker brood rearing rates (No. of cells) before and after feeding honeybee colonies on different diets during spring season of 2016

Where:

Group (A): 50g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement (2 dried brewer's yeast + 3 chick pea meal + 3 honey +1 pollen +15 sugar) +250ml sugar syrup (1:1) / colony / 3 day intervals.

Group (B): 400ml sugar syrup (1:1) +10g pollen grains /colony/3day intervals .

Group (C): 375ml sugar syrup (2:1) /colony / 3day intervals + 100g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement (2 dried brewer's yeast + 3 chick pea meal + 3 honey +1 pollen +15 sugar)/colony/week intervals.

Group (D): 250ml sugar syrup (1:1) +1cm vitamin (Royal star) /colony/3day intervals

Group (E): 50g El-Quanater fresh pollen cake (1kg El-Quanater fresh clover pollen pellets + 350ml honey) + 250ml sugar syrup /colony / 3day intervals.

Group (F): 250ml sugar syrup (1:1) added with 10ml Camphor oil / litter of syrup / colony / 3 day intervals + 100g Brewer's yeast – chick pea cake fortified with 4.2% pollen as a protein supplement (2 dried brewer's yeast + 3 chick pea meal + 3 honey +1 pollen +15 sugar)/colony/week intervals.

Group (G): 100g pollen substitute cake 1 (sugar + protein + attractive material + Vitamins).+ 500ml sugar syrup (2:1)/colony/week/intervals

The stored honey weight

The average amounts of stored honey in grams, at 13day- intervals in the different groups of colonies before and after feeing on different diets are listed in table (2) and Fig. (2). The average weights of stored honey at the end of the experiment in 20/4/2016 were 3502.92, 3120.83, 3047.92, 2482.08, 2304.17, 2070.83 and 1475.83 grams / colony respectively. when feeding the colonies on treatments (C), (G), (A), (E), (B), (F) and (D), respectively. The feeding on treatments (C), (G), (A) and (E) significantly surpassed all other feeding treatments without any significantly differences between them. They came the first in order and caused increases of stored honey by 433.78, 443.15, 662.78 and 286.82% when compared to those before feeding. This may be due to the increase of both amount and concentration of sugar syrup introduced to the colonies at 3 day intervals. They followed by those fed on treatments (B), (F) and (D) they came the second in order with no significant differences between them, and caused increase of stored honey by 241.99, 203.42 and 110.83%, respectively when compared to those before feeding.

Table (2): The average weights of stored honey in grams before and after feeding honeybee colonies on different diets during spring season of 2016, and their relationships

Periods	Diets (A)	(B)	(C)	(D)	(E)	(F)	(G)	F value	L.S.D.
				Before feeding					
15/2 a¯	399.58 ± 63.16	673.75 ± 100.66	656.25 ± 140.64	700.00 ± 140.64	641.67 ± 106.25	682.5 ± 146.15	574.58 ± 110.26	insign	.....
				After feeding					
28/2 b¯	554.17 ± 162.39	705.83 ± 63.97	685.42 ± 148.35	708.75 ± 133.94	656.25 ± 115.75	685.42 ± 129.62	592.08 ± 119.16	insign	.....
12/3 c¯	571.67 ± 148.35	714.58 ± 81.19	880.83 ± 96.03	732.08 ± 132.92	691.25 ± 107.52	729.17 ± 136.15	627.08 ± 114.12	insign	.....
25/3 d¯	796.25 ± 53.22	746.67 ± 152.42	1029.58 ± 114.57	740.83 ± 112.99	805.00 ± 104.39	700.00 ± 147.19	799.17 ± 70.79	insign	.....
7/4 e¯	1968.75 ± 334.15	1531.25 ± 160.63	2350.83 ± 326.82	1356.25 ± 91.07	1895.83 ± 204.17	1519.58 ± 136.52	2164.17 ± 374.19	insign	.....
20 /4 f¯	3047.92** ± 453.49	2304.17** ± 342.94	3502.92* ± 352.55	1475.83* ± 270.42	2482.08** ± 340.59	2070.83** ± 254.27	3120.83** ± 272.86	3.84	1098.64
				Relationships as %Increase or decrease:					
(b¯-a¯)/a¯	38.69	4.76	4.44	1.25	2.27	0.43	3.05		
(c¯- a¯)/a¯	43.07	6.06	34.22	4.58	7.73	6.84	9.14		
(d¯ -a¯)/a¯	99.27	10.82	56.89	5.83	25.45	2.56	39.09		
(e¯ - a¯)/a¯	392.70	127.27	258.22	93.75	195.45	122.65	276.65		
(f¯-a¯)/a¯	662.78	241.99	433.78	110.83	286.82	203.42	443.15		

Where:
a¯: before feeding.
b¯-f¯: after feeding.

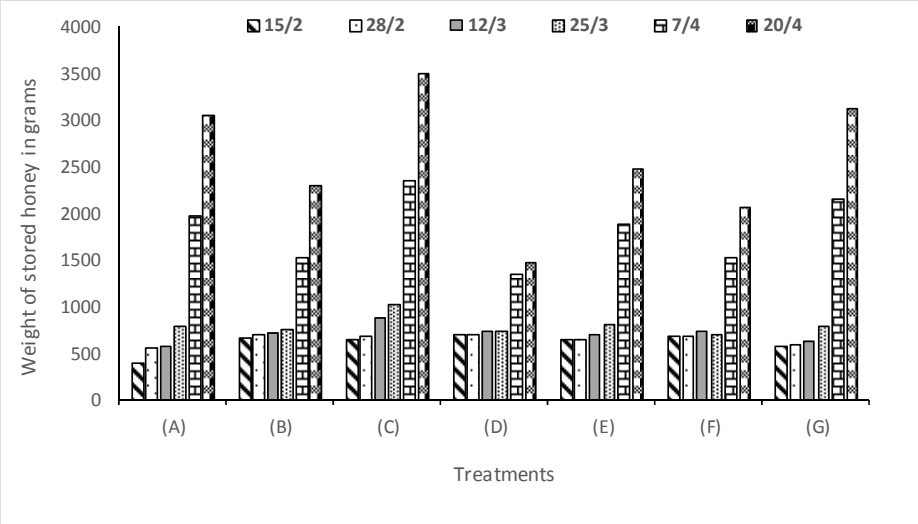

Fig. (2): The average weights of stored honey in grams before and after feeding honeybee colonies on different diets during spring season of 2016

The stored pollen weight

The average amounts of stored pollen grains in grams, at 13 day- intervals in the different groups of colonies before and after feeding on different diets are listed in table (3) and Fig.(3). The average weights of stored pollen grains at the end of the experiment in 20/4/2016 were 249.03, 214.42, 193.75, 188.58, 165.33, 118.83 and 105.92 grams/ colony when feeding colonies on treatments (C), (G), (A), (F), (E), (B) and (D), respectively. No significant differences between the treatments in storing pollen but feeding the colonies on treatment (C) came the first in order and caused an

increase in stored pollen by 315.54% when compared to that before feeding. All the treatments caused an increase in stored pollen by 159.36, 253.75, 204.17, 142.42, 76.91 and 41.37% when compared to those before feeding.

Table (3): The average weights of stored pollen grains in grams before and after feeding honeybee colonies on different diets during spring season of 2016 and their relationships

Periods	Diets (A)	(B)	(C)	(D)	(E)	(F)	(G)	F value	L.S.D.
				Before feeding					
15/2 a˙	54.77 ± 11.68	67.17 ± 16.94	59.93 ± 11.68	74.92 ± 16.31	68.20 ± 7.33	62.00 ± 16.77	82.67 ± 11.05	insign	.....
				After feeding					
28/2 b˙	58.9 ± 15.60	69.75 ± 16.33	77.5 ± 6.76	72.33 ± 11.26	74.4 ± 8.81	66.13 ± 15.92	90.42 ± 6.78	insign	.....
12/3 c˙	95.58 ± 14.38	79.08 ± 15.83	120.38 ± 26.19	75.43 ± 26.70	81.12 ± 14.55	102.3 ± 11.18	105.92 ± 22.52	insign	.....
25/3 d˙	122.45 ± 32.30	90.42 ± 15.71	172.05 ± 23.22	86.8 ± 16.77	98.68 ± 20.80	111.08 ± 21.15	134.33 ± 18.08	insign	.....
7/4 e˙	178.25 ± 27.22	100.75 ± 27.22	211.83 ± 42.29	93.00 ± 35.51	131.75 ± 20.50	181.35 ± 25.06	198.92 ± 40.60	insign	.....
20/4 f	193.75 ± 26.85	118.83 ± 29.79	249.03 ± 33.68	105.92 ± 24.64	165.33 ± 26.22	188.58 ± 35.89	214.42 ± 27.34	insign	.....
				Relationships as % Increase or decrease:					
(b˙-a˙)/a˙	7.5	3.8	29.32	-3.45	9.09	6.67	9.37		
(c˙- a˙)/a˙	74.52	17.74	100.87	0.69	18.94	65.00	28.12		
(d˙ -a˙)/a˙	123.57	34.61	187.08	15.86	44.69	79.17	62.49		
(e˙ - a˙)/a˙	225.45	49.99	253.47	24.13	93.18	192.50	140.62		
(f˙-a˙)/a˙	253.75	76.91	315,54	41.37	142.42	204.17	159.36		

a˙: before feeding.
b˙-f˙: after feeding.

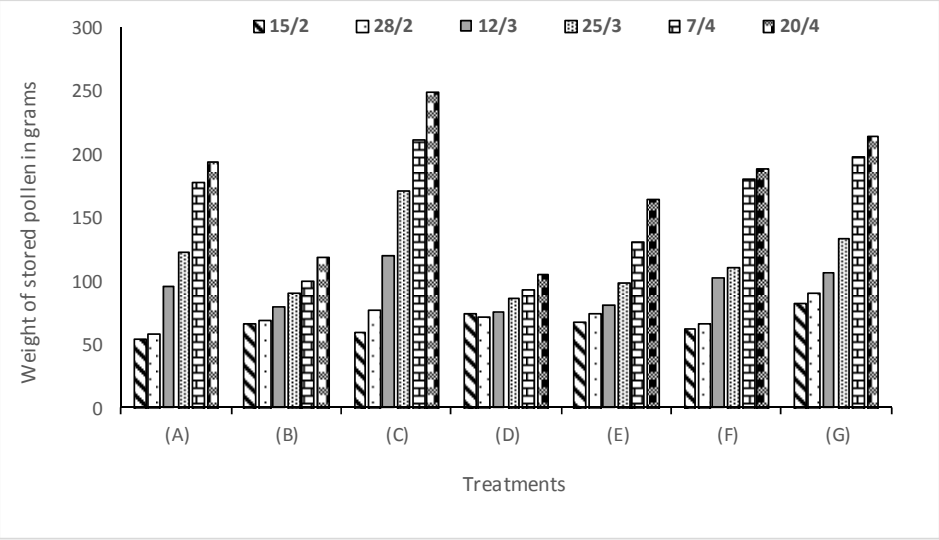

Fig. 3: The average weights of stored pollen grains in grams before and after feeding honeybee colonies on different diets during spring season of 2016

The longevity of honeybee worker:

The results in Table (4) and Fig.(4) show that feeding honeybee colonies on treatment (C) for two months of spring season of 2016 Significantly came the first in order in longevity of caged newly emerged worker bees produced from these colonies and averaged 26.17 days. Feeding the colonies on treatments (G), (A), (E) and (F) significantly came the second in order in longevity of produced newly workers produced from them and averaged 24.27, 22.74, 22.65 and 20.79 days, respectively. Feeding the colonies on treatment (B) and (D) significantly came the last in order in longevity of produced newly workers produced from them and a averaged 19.43 and 16.41 days, respectively.

Table (4): The mean longevity of caged newly emerged worker bees produced from colonies fed on different diets during spring season of 2016

Treat. / Rep.	(A)	(B)	(C)	(D)	(E)	(F)	(G)
1	20.66	21.13	23.50	17.66	22.16	20.79	23.29
2	22.53	19.98	25.37	16.89	23.87	19.88	24.62
3	25.04	17.19	29.64	14.67	21.93	21.72	24.90
Total	68.23	58.29	78.51	49.22	67.96	62.39	72.81
Mean	22.74^{abc} ± 1.27	19.43^{cd} ± 1.17	26.17^{a} ± 1.82	16.41^{d} ± 0.89	22.65^{bc} ± 0.61	20.79^{c} ± 0.53	24.27^{ab} ± 0.49

L.S.D at 0.05 = 3.47

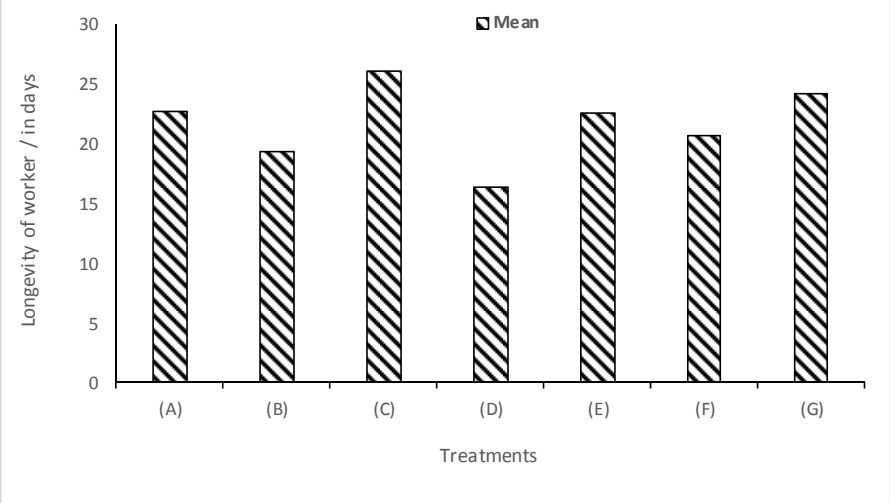

Fig (4): The mean longevity in days of caged newly emerged worker bees produced from colonies fed on different diets during spring season of 2016

In this experiment feeding the honeybee colonies on Brewer's yeast-chick pea cake fortified with 4.2% pollen as a protein supplement plus sugar syrup (2:1) at 3 day intervals for two month of spring season (15/2 – 20/4/2016) produced more broods with a higher brood rearing rate than the other feeding regimes in the experiment. It came the first in order when compared with other feeding regimes, and caused an increase of storing honey and storing pollen. It also came the first in order in longevity of caged newly emerged worker bees. These findings coinside with Doull (1973) and Mladenovic, *et al.* (1999) who stated that the addition of pollen grains to a pollen supplement has been found to increase the acceptability and the consumption of

the supplement and was a direct reflection of the rate of brood rearing in the colony. These finding coincide with El-Banby and El-Sherif (1987 a, b) and El-Sherif *et al*. (1994a,b). These finding disagree with Alves *et al*. (1997) who reported that protein supplement gave smaller area of brood, stored honey and pollen in relation to the control colonies. These findings coincide with those of El-Shaarawi (2001) who stated the feeding colonies on pollen grains substitutes of yeast increased the worker brood area with 15.48% more than the control ones, and coincide with those of Abbasian and Ebadi (2002) who stated that, feeding the colonies on wheat gluten + pollen, bread yeast + pollen increase the longevity of worker bees. El-Waseef (2002) showed that feeding colonies on bran, yeast and check pea reared more brood than those feed on only yeast and check pea. These findings coinside with those of Ghazala (2006) who stated that sugar syrup fortified with Soya bean and Brewer's yeast reared significantly great amount of brood and contradict with the same author who stated that dried pollen gave the lowest amount of brood. These findings coinside with those of Sharma and Gupta (2006) who stated that the substitute consisted of defatted Soya bean, wheat flour, Brewer's yeast or skimmed milk and offered as a patty in sugar syrup had no negative effect on brood development and mortality, and coincide with those of Dastouri *et al*. (2007) who stated that feeding colonies on pea powder or collected pollen was the best performance in brood rearing than milk powder or soya bean meal. These findings contradict with those of Ashour *et al.* (2008a) who stated that the diet B (liquid yeast of *Candida tropicalis*) at 25% in sugar syrup (1:1) had the highest value of mean amounts of sealed worker brood and recorded the highest mean values of the number of combs covered with bee. These findings disagree with those of Abusabbah *et al.* (2012) who stated that the percentage increase to the brood area were found to be 78.1, 77.3, 76.0, 65.0 and 62.1% for the treatment as follows: pollen grain with yeast, check pea with yeast, compressed date, maize with yeast and pollen alone (control), respectively this means that feeding the colonies on pollen alone came the last in order in brood rearing and honey stored. The honey produced was about 25.7, 23.8, 21.4, 16.8 and 12.1% for check pea with yeast, compressed date and maize flour with yeast, pollen (alone), respectively, when compared to those before feedings. These findings coinside with those of Devrim Oskay *et al.* (2015) who stated the colonies fed with 5% protein ratio pollen supplement showed better wintering ability than those fed with 10% and 15% protein ratio pollen supplement and control, and was recommended in feed patties for feeding colonies in winter season. These finding coincide with El-Sherif and El-Banby (1989) who reported that 66.6% sugar syrup significantly surpassed the less concentrations for brood rearing and honey storing. These findings coincide with those of Chandel and Kumar (2000) who reported that the colony strength, brood and pollen area increased with increase of in quantity of sugar feeding.

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ARABIC SUMMARY

تأثير التغذية ببعض مكملات حبوب اللقاح اثناء فصل الربيع على بعض أنشطة طوائف نحل العسل

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أجرى هذا العمل فى منحل القناطر الخيرية (القليوبية) التابع لمعهد وقاية النباتات لدراسة تأثير بعض الأنظمة الغذائية على بناء طوائف نحل العسل أثناء فصل الربيع عام ٢٠١٦. حيث تم مقارنة سبعة معاملات غذائية لطوائف النحل الهجين كرنيولى (كيكة خميرة البيرة- ودقيق الحمص المقواه ب ٤.٢% حبوب لقاح + محلول سكرى (١:١) ، محلول سكرى (١:١) مضاف اليه حبوب لقاح ، كيكة خميرة البيرة- ودقيق الحمص المقواه ب ٤.٢% حبوب لقاح + محلول سكرى (١:٢) ، محلول سكرى (١:١) مضاف اليه فيتامين رويال ستار، كيكة حبوب لقاح القناطر الطازجة زائد محلول سكرى (١:١) ، كيكة خميرة البيرة- ودقيق الحمص المقواه ب ٤.٢% حبوب لقاح + محلول سكرى (١:١) مضاف إليه ١% زيت كافور (١٠مللى/لتر) و كيكة بديل حبوب اللقاح زائد محلول سكرى (١:٢)) وذلك بحساب المعدل اليومى لتربية حضنة الشغالات ، وزن العسل المخزن ، وزن حبوب اللقاح المخزنة ومتوسط عمر الشغالات حديثة الخروج. وقد أظهرت النتائج أن أفضل معاملة كانت كيكة خميرة البيرة – ودقيق الحمص المقواه ب ٤.٢% حبوب لقاح بالاضافة الى المحلول السكرى (١:٢) على فترات كل ثلاث ايام ولمدة شهرين. وجاءت فى المرتبة الأولى وأنتجت أعلى معدل يومى لتربية الحضنة كان ٩٦٨.٨٤ حضنة شغالة / يوم بنسبة زيادة ١٢٧.٢٨% عند مقارنتها بالمتوسط المقابل للطوائف قبل التغذية. متوسط وزن العسل المخزن كان ٣٥٠٢.٩٢ جم/طائفة بنسبة زيادة ٤٣٣.٧٨%عند مقارنتها بقبل التغذية. لم تلاحظ فروق معنوية بين الوجبات الغذائية فى وزن حبوب اللقاح المخزنة ولكن كيكة خميرة البيرة – ودقيق الحمص المقواه ب ٤.٢% حبوب لقاح بالاضافة الى المحلول السكرى (١:٢) أعلى وزن حبوب لقاح مخزنة كانت ٢٤٩.٠٣ جم/طائفة بنسبة زيادة ٣١٥.٥٤% عند مقارنتها بقبل التغذية ومتوسط عمر الشغالات حديثة الخروج كان ٢٦.١٧ يوم.