

## Seasonal influences on rearing of honeybee queens Under nasr city conditions, cairo, Egypt.

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### Abstract

The research was carried out at apiary of Plant protection Dept. Fac. of Agric. Al-Azhar Univ., Cairo, Egypt, to determine the effects of rearing seasons on the quality of honeybee queens under Nasr City conditions. The queens were reared from Carniolan F<sub>1</sub> hybrid colonies with wet grafting. The honeybee queens were raised in eight different periods from February to October (2010 and 2011). Criteria for honeybee queens of reared quality including the acceptance and emergence percentages of the grafted larvae and the weight of newly emerged honeybee queens were studied. The average of acceptance rate was the highest in Feb., Mar. and Apr. (82.22, 62.22 %), (68.89, 88.89 %) and (55.56, 48.89 %) while the lowest rate was in Oct. and May (13.33, 17.78 %) and (20.00, 26.67%) in the two years, respectively. The average of emergence rate was the highest in Jun., Jul., Aug., Sept. and Oct. (100.00, 100.00, 83.33, 100.00 and 100.00 %) (83.33, 100.00, 100.00, 100.00 and 87.50 %), respectively, but the lowest was in Feb., Mar., Apr. and May. (83.78, 70.97, 84.00 and 77.78%) (71.43, 82.50, 72.73 and 83.33 %), respectively, during two successive years. Also, the weight of newly emerged honeybee queens were the highest in Feb., Mar. and Apr. (183.50, 170.50 & 180.00, 197.50 & 178.00, 179.00 mg) while the lowest weight was of newly emerged honeybee queens which was reared in Oct., Sept. and Aug. (151.00, 145.00 & 165.00, 154.00 & 165.50, 162.00 mg) during the two experimental years (2010 and 2011), respectively. The results were statistically analyzed and discussed.

**Key words:** Rearing, honeybee queens, Nasr City.

### Introduction

The queens rearing is one of the major objectives of apiaries especially for the commercial beekeepers, and it is the main factor in beekeeping as there is only one queen in honeybee colony. It is known that the economic characteristics of the honeybee colony are dependent mainly on the quality of its queen (Harris, 2009). The queen quality, in turn, depends on the genetic, the environmental factors, the breeding conditions and the queen rearing methods (Hoopingrander and Farrar, 1959), (Nagi, 1984), (Zedan, 2002) and (John *et al.*, 2011). Aytül Uçak Koç and Mete Karacaoğlu (2004) reared honey bee queens in the Aegean region in Turkey from the end of March to September, they found the better quality of produced queens was obtained from the end of March until the end of April. Genc, and Dodoglu, (2005) found in Turkey also, the highest larvae acceptance rates were observed after dry in July and grafting with addition of royal jelly in both July and August. On the other hand, there are many factors affecting the mating of honeybee queens: (weight of newly emerged queens, age of virgin queens and seasonal variations) El-Sayed, 1977, Severson and Erickson, 1989, Keith and Delaplane (1998) in USA stated that double grafting did not produce heavier queens than did single grafting. If weight is a good indicator of queen quality this study shows that double grafting is not worth the extra effort. Additionally, priming of cell cups before grafting

into them did not improve weight of queens, but it did improve cell acceptance in nurse colonies.

The purpose of this work was to study the influence of the period when virgin queen were reared on the quality of their colonies and study how variability of virgin honeybee queen internal and external characteristics depend on different factors. In the present work these criteria were taken into consideration so as to find out the most suitable way and the best condition for rearing queens under Nasr City conditions. The target of this study was to achieve early production, mass rearing, high quality of virgin queens and more yields of queens rearing.

### Materials and methods

Fifty four honey bee colonies (Carniolan F<sub>1</sub>) hybrid were subjected to this experiment by three colonies for one month through two successive years and it was starter and finisher queenless hives were used and chosen mother colony. Preparing young larvae: In order to obtain larvae at the proper age (24 hours), a prolific queen of a selected colony was confined with a marked empty worker comb from which worker bees had just emerged, in a special cage provided with queen excluders on both sides. So the queen would prefer such comb to deposit eggs. After 24 hours, the comb with newly laid eggs was lifted out in the cage and was placed in the center of the brood nest of the colony and kept in the hive. By

using this technique the queen was obligated to deposit its eggs in the comb provided for this purpose. That helps to define the age of the larvae, which will be used for grafting, not exceeding 24 hours (Diab, 1986, Hagag, 1989 and Dedej, 1994).

The following steps were followed:

- Preparing artificial cups after (Doolittle, 1888) and placed it on the wood bar by wax (15 plastic cups / wood bar).
- Polishing the empty artificial plastic cups before grafting (Lilianke et al., 2003).
- Grafting by wet method after (Doolittle, 1888) which means transferring young worker larvae (24 hours age) from worker cell to plastic cup which contains a small drop of a mixture of 1: 1 distilled water and fresh royal jelly added in each cup.
- Grafted queen cell-cups placed at the frame holding and introduced to starter colonies (45 plastic cups/colony) which their queens were removed before 48 hours (Nageh et al., 2010).
- At the second day all accepted queen cell cups were checked and recorded to determine the acceptance rate.
- After nine days of grafting the sealed queen cells were carefully removed from the bars and each queen cell was put into a screened cage until emergence (by natural incubation) (Laidlaw, 1975).
- After three days all emerged virgin honeybee queens were checked and recorded to determine the emergence rate.
- The emerged virgin honeybee queens were weighted individually quickly in known weight small glass vial by electric balance. The weight of honey bee virgin queens decreased for 3 days after emergence (Eid et al., 1989)
- The resulted data were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D test at 0.05 level, using Duncan multiple rang test (Duncan, 1955).

## Results and discussion

### 1-The acceptance of queen grafted cups and on the emergence of virgin queens:

In the first year (2010) the accepted number of the queen grafted cells was the highest in Feb. and Mar. (37 and 31 cups/colony) in average with acceptance rate of 82.22 and 68.89 %, respectively. While the accepted grafted cups were in moderate numbers in Apr., Jun., Jul., Aug. and Sep. (25, 22, 26, 24 and 22 cups/colony) in average, respectively. The lowest mean numbers of accepted grafted cups were observed in May and Oct. (9 and 6 cups/colony), respectively. On the other hand, the emergence rate of queen cells were the highest in Jun., Jul., Sept. and Oct (100%) while the emergence rate of queen cells were moderate in Feb., Apr., May and Aug. (83.78, 84.00, 77.78 and 83.33 %) but

the lowest rate was in Mar. (70.97 %), respectively. However in the second year (2011) the accepted number of cups was the highest in Mar., Jun. and Feb. (40, 30 and 28 cups/colony) in average with acceptance rate of 88.89, 66.67 and 62.22 %, respectively. The accepted of grafted cups were in moderate numbers in Jul. and Apr. (23 and 22 cups/colony) in average, respectively. The lowest mean numbers of accepted cups were observed in Oct., May, Aug. and Sept. (8, 12, 16 and 16 cups/colony), respectively. The emergence rate of queen cells were the highest in Jul., Aug. and Sept. (100%) while the emergence rate of queen cells were moderate in Mar., May, Jun. and Oct. (82.50, 83.33, 83.33 and 87.50 %), respectively, but the lowest rate was in Feb. and Apr. (71.43 and 72.73 %), respectively. The main causes for decreasing these activities were one of three factors like natural enemies (*Merops spp*, *Varroa mites* and *Vespa orientalis*), climatic factors and the nutrition. There are many trees of *Euclyptus spp* in Nasr city at these region, which enabling was honeybee for workers to gather a lot of nectar and grains. The results were in agreement with that obtained by El-Sarrag (1993) in trials in central Saudia Arabia where queens were successfully reared in February (92 % of grafted larvae were reared and mated) and also, during March – June (82 %) but during the least favorable periods, the percentage was lower (48 % in August – September and 28 % in December – January). Mortality of embryos was significantly correlated with temperature and with pollen collections by the colony. The main cause in this work was predation by birds (*Merops spp*). Nageh, et al. (2010) conducted studies to determine the important factors affecting successful of *A. mellifera carnica* on virgin queens production in Sohag, Egypt at 2007 and 2008. They found that spring season was favorable for queen rearing, followed by Autumn, Summer and Winter. The statistical analysis of data in Tables 1 and 2 showed highly significant differences among that the means accepted of grafted cups or means of emerged queens in different months of the year and revealed that rearing of honey bee queens under Nasr City conditions was favorable in late Winter and early Spring followed by Summer, late Spring and early Autumn. (Tables 1 & 2).

### 2- The weight of newly emerged queens.

Data illustrated in Tables 3 and 4 prove that the weight of newly emerged honeybee queens were the highest in Feb., Mar. (183.50 and 170.50) Mar. (180.00 and 197.50) and Apr. (178.00, 179.00) mg for 2010 and 2011, respectively. However the lowest values were obtained at Sept. (165.00 and 154.00), Oct. (151 and 145) and Aug. (165.50 and 167.50) mg for 2010 and 2011, respectively.

**Table 1.** Numbers and percentages of accepted and emerged honeybee queens/45 cups/ colony during different seasons under Nasr City conditions, (2010).

Season	Month	Accepted cups			Total	Mean	Accept. %	Emerged queens			Total	Mean	Emerge. %
		R1	R2	R3				R1	R2	R3			
Late Winter	Feb.	36	36	39	111	37 a	82.22	31	29	33	93	31 a	83.78
	Mar.	27	33	33	93	31 ab	68.89	20	24	22	66	22 ab	70.97
Spring	Apr.	26	23	26	75	25 cb	55.56	22	20	21	63	21 ab	84.00
	Ma.	9	9	9	27	9 d	20.00	6	7	8	21	7 c	77.78
Summer	Jun.	21	24	21	66	22 c	48.89	21	24	21	66	22 ab	100.00
	Jul.	36	24	18	78	26 cb	57.78	36	24	18	78	26 ab	100.00
Late Summer	Aug.	18	30	24	72	24 cb	53.33	16	24	20	60	20 b	83.33
	Sept.	15	18	33	66	22 c	48.89	15	18	33	66	22 ab	100.00
Early Atu.	Oct.	6	9	3	18	6 d	13.33	6	9	3	18	6 c	100.00

F value for acceptance = 10.746 L.S.D at 5% = 8.858 P = 0.000 F value for emergence = 8.383  
L.S.D at 5% = 10.276 P = 0.0039

The means had the same letter mean no significant.

**Table 2.** Numbers and percentages of accepted and emerged honeybee queens/45 cups/ colony during different seasons under Nasr City conditions, (2011).

Season	Month	Accepted cups			Total	Mean	Accept. %	Emerged queens			Total	Mean	Emerge.%
		R1	R2	R3				R1	R2	R3			
Late Winter	Feb.	36	24	24	84	28 b	62.22	26	18	16	60	20 bc	71.43
	Mar.	45	36	39	120	40 a	88.89	38	29	32	99	33 a	82.50
Spring	Apr.	18	24	24	66	22 cb	48.89	14	18	16	48	16 cd	72.73
	Ma.	15	15	6	36	12 d	26.67	11	13	6	30	10 de	83.33
Summer	Jun.	39	27	24	90	30 b	66.67	30	24	21	75	25 b	83.33
	Jul.	18	27	24	69	23 cb	51.11	18	27	24	69	23 bc	100.00
Late Summer	Aug.	21	18	9	48	16 cd	35.56	21	18	9	48	16 cd	100.00
	Sept.	21	18	9	48	16 cd	35.56	21	18	9	48	16 cd	100.00
Early Atu.	Oct.	9	7	8	24	8 d	17.78	8	6	7	21	7 e	87.50

F value for acceptance = 9.46 L.S.D at 5% = 9.44 P = 0.000 F value for emergence = 8.993  
L.S.D at 5% = 7.819 P = 0.000

The means had the same letter mean no significant.

**Table 3.** The weight in (mg) of virgin queens produced during different seasons under Nasr City conditions at (2010).

Season	Late Winter		Spring		Summer		Late Summer		Early Aut.	
	Rep.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.
1		190	180	170	170	170	150	180	180	150
2		210	190	180	170	180	150	160	160	160
3		200	180	180	180	170	160	170	160	150
4		180	170	180	180	170	170	180	170	160
5		180	170	180	160	170	170	160	160	140
6		180	190	180	160	180	160	170	170	140
7		170	200	170	160	180	170	180	180	150
8		200	170	180	180	170	170	150	150	160
9		170	180	180	180	170	170	170	150	160
10		170	180	180	180	170	160	170	150	140
11		180	180	180	170	170	160	160	180	140
12		180	170	180	170	170	170	160	170	150
13		180	190	180	170	160	180	170	170	160
14		180	180	180	180	170	170	170	180	150
15		180	170	180	180	180	170	170	160	150
16		170	180	170	180	170	170	160	160	160
17		190	180	190	160	180	160	160	170	160
18		190	170	170	160	180	180	150	170	150
19		180	190	170	160	170	180	150	160	150
20		190	180	180	190	170	150	170	150	140
Total		3670	3600	3560	3440	3450	3320	3310	3300	3020
Mean		183.5 a	180 ab	178 cb	172 d	172.5 cd	166 e	165.5 e	165 e	151 f

F value = 25.185 L.S.D at 5% = 5.624 P = 0.000

The means had the same letter mean no significant.

**Table 4.** The weight in (mg) of virgin queen produced during different seasons under Nasr City conditions at (2011).

Season	Late Winter		Spring		Summer		Late Summer		Early Aut.
Rep.	Feb.	Mar.	Apr.	Ma.	Jun.	Jul.	Aug.	Sept.	Oct.
1	200	200	180	150	180	170	170	160	150
2	170	190	170	170	210	170	160	150	140
3	160	200	160	150	170	160	170	160	150
4	170	190	190	170	170	170	150	150	140
5	160	190	170	160	200	160	160	160	140
6	160	180	160	160	180	180	170	160	140
7	170	210	190	150	190	170	170	150	150
8	160	200	170	170	200	160	160	150	140
9	170	190	180	160	190	160	160	150	140
10	160	210	190	150	180	180	170	150	140
11	160	210	190	150	210	160	170	150	140
12	170	190	180	170	170	160	160	150	150
13	170	170	180	190	170	160	150	160	140
14	170	220	190	170	210	170	160	150	150
15	170	200	180	170	190	180	150	160	150
16	180	190	180	150	180	160	170	160	140
17	180	200	180	170	200	170	160	150	160
18	170	200	190	160	190	160	170	150	150
19	200	200	190	170	170	170	150	160	150
20	160	210	160	160	200	180	160	150	140
Total	3410	3950	3580	3250	3760	3350	3240	3080	2900
Mean	170.5 d	197.5 a	179 c	162.5 e	188 b	167.5 de	162 e	154 f	145 g

**F value = 54.076**      **L.S.D at 5% = 6.237**      **P = 0.000**

The means had the same letter mean no significant.

These results are in agreement with that obtained by **Manino (1982)** in Italy who mentioned that successfully queen mating requires good weather, but grafting and the development of queen cells were only slightly affected by climatic conditions. **Szabo (1973)** found that the weight of queens at emergence appeared to be reliable character for selecting for grafting the good queens, **El-Sayed (1977)** in Egypt, mentioned that the number of ovarioles was highly depended upon the weight of emerged queens in Summer followed by Spiring and lastly Autumn. He added that implication of weight of queens at emergence on the number of ovarioles was higher than that of prior laying eggs. The present results were statistically analyzed and there were significant differences among the mean weight of queens emerged during the different period of the year. The results reflected that the queens produced in Feb., Mar. and Apr. were heavier than those emerged in other period with highly significance. Finally we can produce mass honeybee queens early in Feb., Mar. and Apr. under Nasr City conditions when available the flowers of Eucalypts trees to supply beekeepers at other regions to activate their apiaries early before nectar flow starting in other Egyptians regions.

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## دراسات عن تأثير الفترات والمواسم على تربية ملكات نحل العسل تحت ظروف مدينة نصر، القاهرة، مصر.

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أجريت هذه الدراسة بغرض التعرف على العوامل الهامة التي تؤثر على تربية وإنتاج ملكات نحل العسل تحت ظروف مدينة نصر وذلك خلال عامي ٢٠١٠ و ٢٠١١ حيث اتضح من هذه الدراسة أن هناك تأثيراً واضحاً لكل من المواسم والفترات التي تربي فيها ملكات نحل العسل العذارى خاصة على نسبة نجاح التطعيم - نسبة نجاح الإنبثاق- وزن الملكات العذارى الناتجة. حيث اتضح من خلال النتائج أن أعلى معدل لنجاح التطعيم كان خلال أشهر فبراير، مارس وأبريل (٨٢,٢٢، ٦٢,٢٢%)، (٨٨,٨٩ و ٦٨,٨٩%) و(٥٥,٥٦ و ٤٨,٨٩%) على التوالي خلال سنتي الدراسة ثم بعد ذلك إنخفض إنخفاضاً ملحوظاً خلال شهر مايو (٢٠ و ٢٦,٦٧%) ثم عاود الإرتفاع مرة ثانية خلال شهري يونيه و يوليه ثم إنخفض مرة أخرى إنخفاضاً ملحوظاً خلال شهري سبتمبر و اكتوبر حيث بلغ (٤٨,٨٩ و ٣٥,٥٦%)، (١٧,٧٨ و ١٣,٣٣%) على التوالي على مدار عامي الدراسة على العكس من ذلك إنخفض معدل الإنبثاق لملكات نحل العسل العذارى الناتجة خلال أشهر فبراير و مارس وأبريل فى حين أنه إتجه نحو الإرتفاع خلال أشهر يونيه و يوليه وأغسطس كما أنه من خلال الدراسة تبين اختلاف أوزان ملكات نحل العسل العذارى الناتجة فكانت أعلاها وزناً خلال أشهر فبراير ، مارس و أبريل (١٨٣,٥ ، ١٧٠,٥ & ١٨٠ ، ١٧٩,٥ & ١٧٨ ، ١٧٩ مجم) على التوالي وأقلها وزناً خلال أشهر أغسطس و سبتمبر و اكتوبر (١٦٥,٥ ، ١٦٢ ، ١٦٥ & ١٥٤ ، ١٥١ & ١٤٥ مجم) على التوالي على مدار عامي الدراسة. ويمكن القول بأن أفضل فترات إنتاج ملكات نحل العسل العذارى تحت ظروف مدينة نصر تتمثل فى أشهر فبراير و مارس وأبريل و يونيه و يوليه حيث تتوفر مصادر الرحيق وحبوب اللقاح من اشجار الكافور المنتشرة بهذه المنطقة وحيث يمكن إنتاجها بأعداد أكبر وأوزان أفضل. كما يمكن الاستفادة بالملكات المنتجة مبكراً فى فبراير وإمداد المناحل بها.