

## Effect of thermal insulation and feeding treatments on early spring honey bee queen rearing

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### Abstract

These experiments were conducted at the apiary of Faculty of Agriculture, Moshtohor, Benha Univ., during early spring of two successive years 2013 and 2014 to estimate the effect of wintering and feeding treatments on honey bee queen rearing. Eighteen colonies (9 colonies F1 Italian bees and 9 colonies F1 Carniolan bees). Each group were divided into three groups one of them (3 colonies) were received the pollen substitute and sugar solution in normal Langstroth hives, the second group (3 colonies) was received the pollen substitute and sugar solution coated with thermal insulator while the third group (3 colonies) were received sugar solution only in normal Langstroth hives as control. Results indicated that F1 Italian bees are better more than F1 Carniolan bees in all tested queen rearing parameters (number of queen cells; length of queen cells; number of emerging new queens and queens fresh weight) during the two years of study. Data also indicated that feeding honey bee colonies with pollen substitute and sugar syrup affected positively on all queen rearing parameters and gave a good morphological virgin queens.

**Keywords:** *Apis mellifera* L., queen rearing, wintering, feeding.

### Introduction

Queen rearing began when the brood nest was congested and nectar and pollen were abundant, obtained. March was the maximum month for queen cups production (Ismail, 2001). The fed colonies were active in building more queen cups than unfed ones and higher building queen cups in March (El-Waseef, 2002). Also, Shoreit *et al.* (2002) found that the maximum total of queen cells and queen cups was found during February-April period or swarming period.

There were clearly significant differences between the all feeding bee colonies with diets and control in the mean of worker brood area during the experimental period of February and March (Abd El-Wahab, 2016).

Honey bee (*Apis mellifera* L.) colonies need pollen and nectar to fuel foraging flights, generate heat to thermoregulate their nest and to rear brood. Nectar is a carbohydrate source, while pollen supplies the bees with the protein, lipids, vitamins and minerals needed to rear larvae (Manning, 2001). In early spring before pollen and nectar are available or at other times of the year when these materials are in short supply, supplementary feeding may help the colony survive or make it more populous and productive (Standifer, 1973).

The possibility of improving the efficiency of beekeeping by maximizing honey production, crop pollination, to overcome pesticide damage and produce strong colonies for package-bee production, lies in the development of an effective pollen substitute to feed the colonies when pollen is in scarce (Dadant, 2000).

Since queens cannot be reared during every season, beekeepers are often unable to obtain queens

at critical times of the year, especially in early spring. Thus, the reliable storage of queens from when they are reared until they are needed for re-queening is of great importance (Morse, 1979).

In dearth period because of less floral rewards, supplement feeding is necessary for maintenance of bee population. Different pulse flour has been used by several workers as a protein feed for bees (Dastouri and Sis, 2007).

The quality of the queen bee determines the benefits received from honey bee colony as through the queen, via its progeny, the productivity, temperament and behavior of the colony can be manipulated by the beekeeper. Various environmental factors affect the quality of the queen bees, as well as the rearing season and meteorological conditions influenced the rate of queen development (Mahbobi *et al.*, 2012).

This research aimed to estimate the effect of wintering and feeding treatments on honey bee queen rearing parameters (number of queen cells; length of queen cells; number of emerging new queens and queen's fresh weight) during the two years of study.

### Materials and Methods

These experiments were conducted at the apiary of Faculty of Agriculture, Moshtohor, Benha Univ., during early spring of two successive years 2013 and 2014 to estimate the effect of wintering and feeding treatments on honey bee queen rearing.

### Honeybee colonies

Eighteen honey bee colonies were used for this experiment (9 colonies F1 Italian bees and 9 colonies

F1 Carniolan bees). Each group were divided into three groups one of them (3 colonies) were received the pollen substitute and sugar solution in normal Langstroth hives, the second group (3 colonies) was received the pollen substitute and sugar solution coated with thermal insulator (**Photo 2**) while the third group (3 colonies) were received sugar solution only in normal Langstroth hives as control. The same groups were used for queen rearing with grafting method (**Laidlaw, 1979**) during July month (Corn season).

### Pollen substitutes

The composition of pollen substitute was as the following; Soybean flour (0.5), the chemical compositions of Soybean flour determined by **Hammad (2000)** as follows: humidity 6.58%, protein 50.88%, fat 5.41%, fiber 6.54% and ash 6.73%. Dried Brewer's yeast (0.5): the chemical compositions of Dried Brewer's yeast determined by **Atallah (1975)** as follows: humidity 9.5%, crude protein 40.5%, other extracts 1.5% and ash 6.25% in addition to vitamin B1, B2 and nicotinic acid. Milk (0.25): cow's milk contains, on average, 3.4% protein 3.6% fat, 4.6% lactose, 0.7% minerals and water 87.5% (**Jensen, 1995**). Powdered sugar. All materials were mixed with honey, citrus juice.

### Queen rearing

The dray grafting method was used in this experiment in wax cubs as described by **Fert (1997)** and **Dedej et al (1998)**. The percentage of successful queen cups was calculated after virgin queen emerging. This experiment was carried out at the first of March during the two years of study. At 8th day of the grafting; queen cells number and queen cells length by cm were recorded. At 10th day of the grafting; the queen cells were released from their frames separated, then kept under hemisphere cages



**Photo 1.** Queen cells from grafting method

inner same their colonies until the emergence. The virgin queens which produced from the previous experiment were put in small wooden cages to calculate the emerging virgin queen's fresh weight.

## Results and Discussion

### Effect of wintering and feeding treatments on honey bee queen rearing

From data presented in **Tables (1&2)** graphically illustrated by figs. (1&2) it was clearly that F1 Italian bees is better than F1 Carniolan bees in all tested queen rearing parameters (number of queen cells, length of queen cells, number of emerging new queens and virgin queens fresh weigh) during the two years of study. Data also indicated that feeding honey bee colonies with pollen substitute and sugar syrup affected positively on all queen rearing parameters and gave a good morphological virgin queens. Data also indicated that covering hives with thermal insulator during winter season make honey bee colonies more ability for queen rearing and increasing the most tested queen rearing parameters during the two years of study. It was clearly that wintering and feeding treatments increase honey bee worker's population. **Wilkinson and Brown (2002)** reported that the queen rearing depends on factors such as numbers of nurse bees available, quantities of brood food in their hypopharyngeal glands, and the genetic predisposition of the race of bee to rear queen cells.

These data were harmony with **Mahbobi et al. (2012)** who indicated that the supplemental feeding significantly increased most morphological characteristics of reared queens. Also, **Krol et al. (1992)** reported that queens reared in colonies fed with sugar syrup supplemented with vitamin B, recorded 11% heavier and have more 6% overriols.



**Photo 2.** Langstroth hive covered by thermal insulator.

**Table 1.** Effect of wintering and feeding treatments on honey bee queen rearing by grafting method during March 2013.

Treatment	F1 Italian bees				F1 Carniolan bees				
	Mean of queen cells No.	Mean of queen cells Length (cm.)	Mean of emerging queens No.	Mean of Queen's fresh weight (g.)	Mean of queen cells No.	Mean of queen cells Length (cm.)	Mean of emerging queens No.	Mean of Queen's fresh weight (g.)	
Control	27	1.52	22	0.16	25	1.5	21	0.16	
Wintering treatment	Only sugar syrup	38	1.71	31	0.18	34	1.7	28	0.17
	Pollen substitute	54	2.1	50	0.2	51	1.9	48	0.19

**Table 2.** Effect of wintering and feeding treatments on honey bee queen rearing by grafting method during March 2014.

Treatment	F1 Italian bees				F1 Carniolan bees				
	Mean of queen cells No.	Mean of queen cells Length (cm.)	Mean of emerging queens No.	Mean of Queen's fresh weight (g.)	Mean of queen cells No.	Mean of queen cells Length (cm.)	Mean of emerging queens No.	Mean of Queen's fresh weight (g.)	
Control	31	1.61	27	0.16	28	1.60	25	0.16	
Wintering treatment	Only sugar syrup	41	1.77	36	0.17	39	1.71	34	0.18
	Pollen substitute	52	2.20	51	0.22	51	2.00	46	0.19

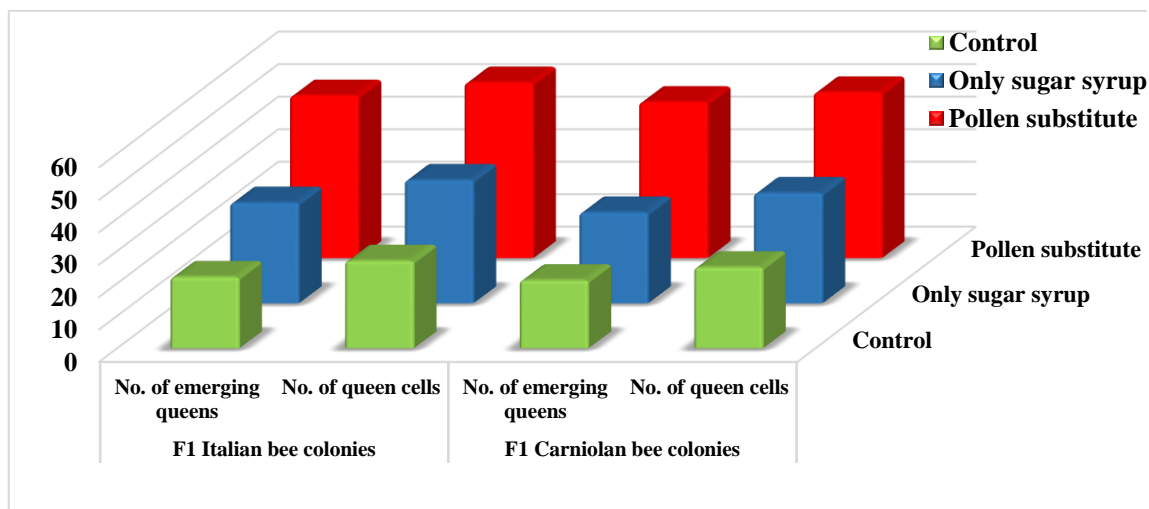


Fig 1. Effect of wintering and feeding treatments on queen rearing during March 2013

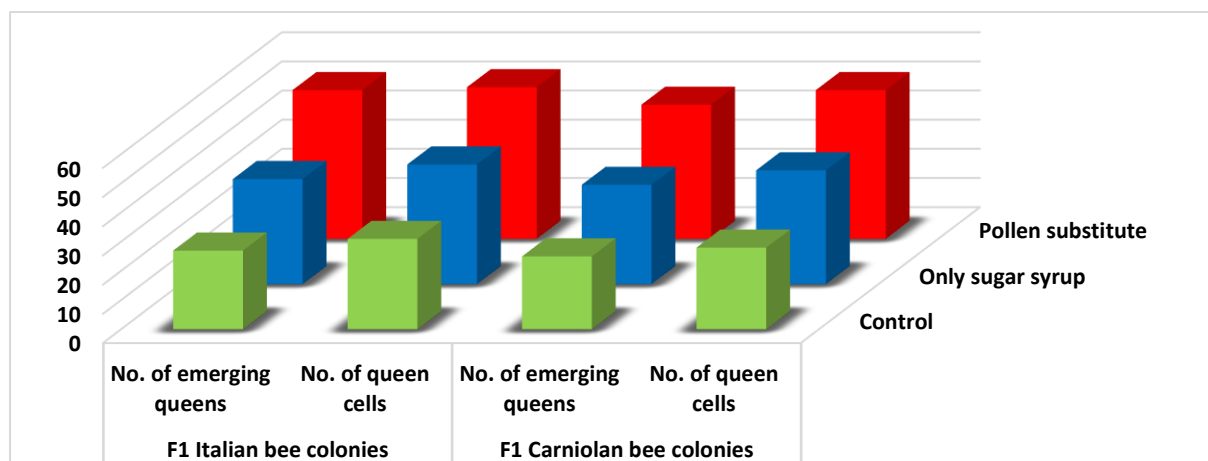


Fig 2. Effect of wintering and feeding treatments on queen rearing during March 2014

### Conclusion

The obtained results indicated that F1 Italian bees is more better than F1 Carniolan bees in all tested queen rearing parameters (number of queen cells; length of queen cells; number of emerging new queens and queens fresh weight) during the two years of study. Data also indicated that feeding honey bee colonies with pollen substitute and sugar syrup affected positively on all queen rearing parameters and gave a good morphological virgin queens.

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## المخلص العربي

### تأثير العازل الحراري ومعاملات التغذية على تربية ملكات نحل العسل في بداية الربيع

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أجريت هذه التجارب بمنحل كلية الزراعة بمشهر جامعة بنها في فترة الربيع المبكر خلال عامي ٢٠١٣ و ٢٠١٤ لمعرفة تأثير معاملات التشتيه والتغذية على تربية ملكات نحل العسل. وفيها تم استخدام ١٨ طائفة نحل عسل (٩ طائفه هجين أول كرنبولي و٩ طائفه هجين أول إيطالى) وقسمت كل مجموعته إلى ثلاث مجموعات بكل مجموعه ٣ طوائف أول مجموعة تم تغذيتها ببديل حبوب اللقاح والمحلول السكري في خلايا لانجستروث عاديه بينما المجموعة الثانية إستقبلت بديل حبوب اللقاح والمحلول السكري في خلايا لانجستروث مغطاة بالعازل الحراري أما المجموعة الثالثة تم تغذيتها على محلول سكري فقط في خلايا لانجستروث عاديه. أثبتت النتائج أن كل قياسات تربية الملكات في النحل الإيطالى (أعداد البيوت الملكيه - طول البيت الملكى - أعداد الملكات العذارى المنتجة - وزن الملكات العذارى) كانت أعلى من الموجوده في النحل الكرنبولي خلال عامي الدراسة. أوضحت النتائج أيضا أن تغذية طوائف نحل العسل ببديل حبوب اللقاح وبالمحلول السكرى قد أثر إيجابياً على جميع قياسات تربية الملكات وأعطى صفات جيده للملكات العذارى.

**الكلمات الدالة:** نحل العسل - تربية الملكات - التشتية - التغذية