

## EFFECT OF STIMULATIVE FEEDING WITH SOME POLLEN SUBSTITUTES ON BROOD REARING ACTIVITY OF HONEYBEE COLONIES

Serag El-Dien, F.Sh.<sup>(1)</sup> and Asmaa A. Eissa<sup>(2)</sup>

(1) Plant Protect. Res. Inst. Sakha, Agric. Res. St. Agric. Res. Center

(2) Plant Protect. Res. Inst. Giemeza, Agric. Res. St. Agric. Res.Center

### ABSTRACT

Study was conducted in the apiary of Sakha Agricultural Research Station, Kafr El-Sheikh, The Arab Republic of Egypt during two dearth periods, the first period elapsed from March 7<sup>th</sup> until April 25<sup>th</sup>, 2002, the second one from September 20<sup>th</sup>, 2002 to January 18<sup>th</sup>, 2003. Results indicated significant differences between the mean brood areas in the colonies fed on diet (C) and the other diets except with diet. It could be arranged means of brood areas in the following descending order, (C) > B) > (A) (814) in the first period. In the second one, statistical analysis revealed significant differences between the mean brood areas in the colonies fed on diet (C) and the other diets. At the sample period, the mean value of sealed brood area (192.9/in<sup>2</sup>) in colonies fed on diet (A) was least comparing with the other diets. It could be noticed that measurements of sealed brood area in the first period were higher than those in the second one. On the other hand, increase of brood production in colonies fed on diet (C), (B) and (A) comparing with control were 36.64, 25.99 and 18.83% in the first period while in the second one, they were 66.35, 31.42 and 18.42% in colonies fed on the same diets, respectively. It could be concluded that beekeepers can use diet (C) as pollen substitute during two dearth periods of flowering plants in Kafr El-Sheikh region to build up brood areas of colonies before main nectar flow of clover.

### INTRODUCTION

Pollen is a principal source of non-liquid food, it contain most of the essential nutrients for production of royal jelly, which nourishes the larval queen and young workers larvae (Walter, 1980).

Pollen grains are the main source of protein, fat, vitamins and minerals. The protein content of pollen ranges from 7-40% (Johanson & Johanson, 1977 and Dietz, 1979) During dearth periods and when pollen grains are not available or in short supply, it is of advantage to provide essential nutrients in the form of pollen substitutes or supplements (Taber and Poole, 1974). Then, any appropriate protein source is satisfactory for growth of emerging bee and development of their hypopharyngeal glands (Haydac and Dietz, 1965). There are several investigators formulated number of pollen substitutes as it helps much in maintaining colonies with sufficient brood area during the whole season, i.e., Mohanna, 1977; Herbert, 1981; Imdrof *et al.*, 1988; Abd El-Aziz, 1992; Awad, 1998; Mladenovic *et al.*, 1999 and Mohammad, (2002).

The present investigation aimed to evaluate some pollen substitutes to help the beekeepers to solve the problem of short supply or low pollen availability during dearth periods of flowering plants at Kafr El-Sheikh region.

## MATERIALS AND METHODS

The current study was conducted in the apiary of Sakha Agricultural Research Station, Kafr El-Sheikh, The Arab Republic of Egypt during two dearth periods, the first period from 7/3/2002 until 25/4/2002, the second one from 20/9/2002 to 18/1/2003. In the apiary forty honeybee colonies of first hybrid Carniolan bees of about equal strength containing at least five combs were randomly selected. The colonies were arranged in four groups of ten colonies each. Three diets were used in this study and mixed with sugar solution, then offered to the bees in cake form and placed directly over the brood nests covered with plastic sheets to avoid drying. The control group was offered sugar solution alone (1: 1). The protein content in the mixtures were from 20-25% resembling protein percentage in natural pollen sources. The mixtures are:

- A. one part Brewer's yeast, + one part date paste (Agwa), + 5 parts defatted soybean flour, + 3 parts sugar, (concentrated solution).
- B. one part Brewer's yeast, + 5 parts defatted soybean flour, + one part skimmed power milk, + 3 parts sugar, (concentrated solution).
- C. one part Brewer's yeast, + one part date paste (Agwa), + 5 parts defatted soybean flour, + one part skimmed powder milk, + 2 parts sugar, (concentrated solution).

Each colony fed weekly with 100 g of each tested diets during the two above dearth periods except control group only received sugar solution. Sealed brood areas were measured at 12-day intervals using a wire frame divided into square inches (Moeller, 1967). Statistical analysis of the obtained data was done adopting the analysis of variance and the means were compared by L.S.D. test (Fisher, 1944).

## RESULTS AND DISCUSSION

### I. Brood rearing of honeybee colonies during the first period (7<sup>th</sup> March, 2002 to 25<sup>th</sup> April, 2002):

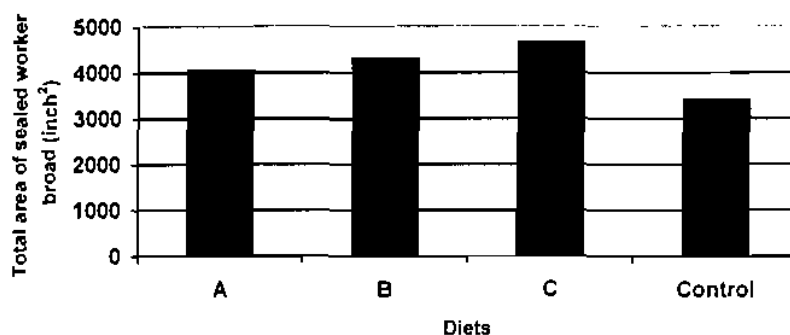
Data in Table (1) and Fig. (1) show sealed brood area in the colonies which were fed with different pollen substitutes during the first dearth period elapsed from March, 7<sup>th</sup>, 2002 until April, 25<sup>th</sup> 2002. Sealed brood areas were increased gradually showing a maximum of 980, 963, 932 and 914 in<sup>2</sup>/group for the colonies fed on diet (C), (B), and (A), respectively. Significant differences between the mean brood areas in the colonies fed on diet (C) (936 in<sup>2</sup>) and the other diets except with diet. Means of brood areas may be arranged in the following descending order; (C) (936) > (B) (863) > (A) (814) as shown in Table (1). Results agree with those reported by Shorit and Hussein (1993) who found that colonies were fed with sugar syrup mixed with a protein supplement during March, reared significantly more brood and produced more significantly honey than control colonies fed only on sugar

syrop. Also, Abd El-Aziz (1992) found significant differences between the mean brood areas in the colonies fed on corn flour and each of broad bean, soybean + brewer's yeast, soybean, fresh pollen and brewer's yeast in Minia region.

**Table (1): Areas of sealed worker brood (inch<sup>2</sup>) in honey bee colonies fed on different diets during the period (March, 7<sup>th</sup> 2002- April, 25<sup>th</sup> 2002.**

Dates \ Diets	Control (sugar solution)	Diet (A)	Diet (B)	Diet (C)
March, 7 <sup>th</sup> 2002	885	700	740	911
March, 19 <sup>th</sup> 2002	635	795	863	923
April, 1 <sup>st</sup> 2002	669	814	866	928
April, 13 <sup>th</sup> 2002	646	847	883	938
April, 25 <sup>th</sup> 2002	580	914	963	980
Total	3415	4070	4315	4680
Mean	683 d	814 c	863 c	936 a
L.S.D.	61.40			
% increasing	-	18.83	25.99	36.64

Means with the same letter are not significantly different at 0.05



**Fig. (1): Areas of sealed worker brood during first period (7/3/2002 – 25/4/2002)**

**II. Brood rearing of honeybee colonies during the second period (September, 20<sup>th</sup> 2002 to January, 18<sup>th</sup> 2003):**

As shown in Table (2) and Fig. (2) sealed brood areas were increased gradually to reach a maximum at the end of this period and represented by 403, 312, 296 and 291 in<sup>2</sup>/group for the colonies fed on diet (C), (B) and (A), respectively. Statistical analysis revealed significant differences between the mean brood areas in the colonies fed on diet (C) (271 in<sup>2</sup>) and the other diets. Also, there were no significant differences in sealed brood areas of the colonies fed on diet (C) with means of 214.10 in<sup>2</sup>.

The mean value of sealed brood area (162.91 in<sup>2</sup>) in colonies fed on diet (A) was the least comparing with the other diets. It could be noticed that

measurements of sealed brood area in the first period were higher than those in the second one. This may be due to the favourable weather conditions in the first period (March, 7<sup>th</sup> to April, 25<sup>th</sup> 2000) and the tendency of the colonies to build up their strength before main nectar flow. On the other hand, increase of brood production in colonies fed on diet (C), (B) and (A) comparing with control were 36.64, 25.99 and 18.83% in the first period (Table 1) while in the second period, increase of brood production were 66.35, 31.42 and 18.42% in colonies fed on the same diets, respectively (Table 2). In this respect, Wille and Schafer (1970) showed an increase of brood production of 43 and 73% in colonies fed on substitutes comparing with unfed ones. Agree with these reported by Strovkov (1967) who found that the amount of brood area was greatest when the bees fed on bee breed and he added that a mixture of yeast, dried milk and soybean flour was more effective for brood rearing than any of these substitutes alone.

**Table (2): Areas of sealed worker brood (inch<sup>2</sup>) in honeybee colonies feed on different diets during the period (September, 20<sup>th</sup> 2002 -January, 18<sup>th</sup> 2003).**

Dates	Diets	Control (sugar solution)	Diet (A)	Diet (B)	Diet (C)
September, 20 <sup>th</sup> 2002		165	138	166	140
October, 2 <sup>rd</sup> 2002		161	140	175	161
October, 14 <sup>th</sup> 2002		155	144	176	192
October, 26 <sup>th</sup> 2002		140	192	196	221
November, 7 <sup>th</sup> 2002		115	192	200	271
November, 19 <sup>th</sup> 2002		87	195	200	271
December, 1 <sup>st</sup> 2002		155	198	216	280
December, 13 <sup>th</sup> 2002		160	200	224	321
December, 25 <sup>th</sup> 2002		166	210	240	331
January, 6 <sup>th</sup> 2003		210	222	266	390
January, 18 <sup>th</sup> 2003		278	291	296	403
Total		1792	2122	2355	2981
Mean		162.91 d	192.91 c	214.10 b	271 a
L.S.D.		18.80			
% increasing		-	18.42	31.42	66.35

Means with the same letter are not significantly at 0.05 level .

Abd El-Aziz (1992) found that measurements of sealed brood in colonies fed on pollen substitutes were higher in the second period (March 10<sup>th</sup> to May 9<sup>th</sup>) than those in the first period (December 8<sup>th</sup> to March 2<sup>nd</sup>) in Minia region. It could be concluded that beekeepers can use Diet (c) which consists of [one part Brewer's yeast + one part date past + 5 parts deffatted soybean flour + one part Skimmed powder milk + 3 parts sugar (concentrated solution)] during dearth periods of flowering plants which elapsed from March 7<sup>th</sup> until April 25<sup>th</sup> and from September 20<sup>th</sup> to January 18<sup>th</sup> of the following year in Kafr El-Sheikh region to build up brood areas of colonies before main nectar flow of clover.

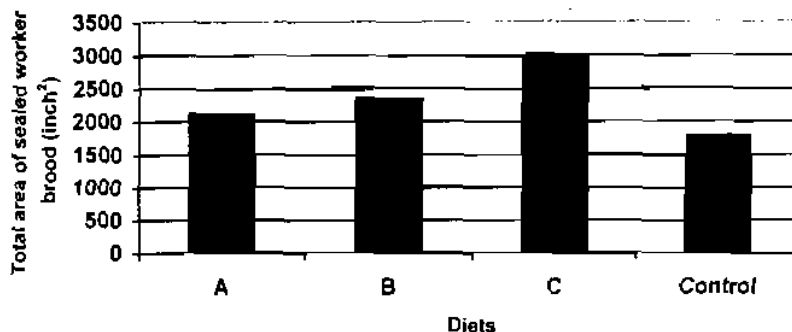


Fig. (2): Areas of sealed worker brood during second period (20/9/2002 – 18/1/2003)

### ACKNOWLEDGEMENT

Thanks are due to Dr. Gamal A. El-Mezayyen (Plant Protection Research Institute, Sakha, Agricultural Research Station) for reviewing an early draft of the manuscript.

### REFERENCES

- Abd El-Aziz, M.A. (1992). *Studies on the effect of feeding honey bees colonies with pollen substitutes in Minia region*. M.Sc. Thesis, Fac. of Agric. Minia Univ. pp. 96.
- Awad, A.E.A. (1998). *Studies on the types and amounts of pollen grains and its effect on activities of honeybee colonies in Dakahliya Governorate*. M.Sc. Thesis, Fac. Agric. Al-Azhar Univ. pp.130.
- Dietz, A. (1979). *Nutrition of the adult honeybee from the hive and the honeybee*. pp. 125-156. Hamilton, Ill: Dadant & Sons Inc.
- Fisher, R.A. (1944). *Statistical method for research worker*. 9<sup>th</sup> Ed Oliver and Boyd. Edinburgh and London U.K.
- Haydac, M.H. and A. Dietz (1965). Influence of the diet on the development and brood rearing of honeybees. *Int. Beekeep. Congr. Bucharest*, 20: 158-162.
- Herbert, E.W. (1981). Effect of diet on the rate of brood rearing by naturally and instrumentally inseminated queens. *Apidologie*, 11(1): 57-62.
- Imdrof, A.; V. Kilchenmann and C. Maquelin (1988). What is the effect of spring pollen feeding on the development of colonies Liebfeld. *d'Apiculture* 85(3): 67-76 (C.F. Apicult. Abst. 39(4)/1998).
- Johanson, T.S.K. and M.P. Johanson (1977) Feeding honeybees pollen and pollen substitutes. *Bee World*, 58(3): 105-118, 135: 161-164
- Mladenovic, M.; V. Mladan and N. Dugalic-Vrindic (1999). Effects of a vitamin mineral preparation on development and productivity of bee colonies *Acta Veterinaria (Beograd)* 1999, Vol. 49, No 213, pp., 177-184.
- Moeller, F.E. (1967). Honeybee preference for pollen supplements or substitutes. *Amer. Bee J.* 107(2): 48-50.

- Mohammad, R.E.H. (2002). Studies on rearing and production of honeybee queens, *Apis mellifera*, Ph.D. Thesis, Fac. of Agric. Zagazig Univ. 189 pp.
- Mohanna, N.M.F. (1977). Pollen substitutes and honey production. Ph.D. Thesis, Fac. of Agric. Alexandria Univ. 100 pp.
- Shoreit, M.N. and M.H. Hussein (1993). Field tests with some protein supplements for feeding bees at Assiut Governorate. Egyptian J. of Applied. Science, 8: 6, 366-375.
- Stroikov, S.A. (1967). Ability of bees to digest nutrient material from pollen substitute. Trady Marchno-issled. Inst. Pchol. 89: 106 (C.F. Apicult., Abstr. 21: 425-1970).
- Taber, S. and H.K. Poole (1974). Rearing and mating of queen and drone honeybees in winter. Amer. Bee. J. 114(1): 18-19.
- Walter, L.G. (1980). Bees, beekeeping, honey and pollination. The AVI Publishing, Inc., Westport, Connecticut.
- Wille, H. and H. Schafer (1970). Feeding trials using a liquid pollen substitutes. Schweiz. Bienenztg. 93(10): 483-494 (C.F. Apicult. Abstr. 23(1): 148, 1972).

### "تأثير بعض بدائل حبوب اللقاح على نشاط تربية الحضنة في طوائف نحل العسل

فريد شوقي سراج الدين ، أسماء اتور عبد الخالق عيسى\*

معهد بحوث وقاية النباتات - محطة البحوث الزراعية بسخا - مركز البحوث الزراعية

\* معهد بحوث وقاية النباتات - محطة البحوث الزراعية بالجميزة - مركز البحوث الزراعية

أجريت هذه الدراسة بمنحل محطة البحوث الزراعية بسخا - كفر الشيخ - جمهورية مصر العربية خلال فترتين حيث كانت الفترة الاولى ، من ٧ مارس ، حتى ٢٥ إبريل ٢٠٠٢م أما الفترة الثانية فكانت من ٢٠ سبتمبر ٢٠٠٢ إلى ١٨ يناير ٢٠٠٣م حيث استخدمت ثلاثة أنواع مسن الوجبات كبديلات حبوب اللقاح.

أوضحت النتائج المتحصل عليها وجود فروق معنوية في إنتاج الحضنة وذلك في الخلايا التي تغذت على الوجبة (C) وذلك مقارنة بالوجبات الاخرى . أيضا يمكن ترتيب متوسط إنتاج الحضنة في الوجبات الثلاثة تنازليا كالآتي: الوجبة (C) اكبر من الوجبة (B) وذلك في الفترة الاولى أما في الفترة الثانية فقد أظهر التحليل الاحصائي وجود فروق معنوية أيضا في إنتاج الحضنة وذلك في الخلايا التي تغذت على الوجبة (C) وذلك مقارنة بالوجبات الاخرى كذلك وجد في نفس الفترة أن اقل متوسط لإنتاج الحضنة كان ١٦٢,٩١ بوصة مربعة وذلك في الخلايا التي تغذت على الوجبة (A) مقارنة بالوجبات الاخرى كما لوحظ أيضا ان قياسات الحضنة المقفولة في الفترة الاولى ، كانت أكبر من مثيلاتها في الفترة الثانية ومن ناحية اخرى كانت الزيادة في إنتاج الحضنة وذلك في الخلايا التي غذيت على الوجبات (C) ، (B) و (A) مقارنة بالكنترول هي ٣٦,٦٤ ، ٢٥,٩٩ ، ١٨,٨٣% وذلك في الفترة الاولى أما في الفترة الثانية فكانت ٦٦,٣٥ ، ٣١,٤٢ ، ١٨,٤٢% وذلك في الخلايا التي غذيت على نفس الوجبات على الترتيب. يمكن أن نستنتج مما سبق أن النحالين يمكن أن يستخدموا الوجبة (C) كبديل لحبوب اللقاح وذلك خلال الفترات التي تختار إلى المحاصيل المزهرة في منطقة كفر الشيخ لزيادة إنتاج الحضنة في الخلايا قبل موسم فيض رحيق البرسيم وهو الموسم الرئيسي بالمنطقة.