

EFFECT OF POLLEN SUBSTITUTES FEEDING ON SOME ACTIVITIES OF TWO HONEYBEE RACES

ABD EL SALAM, A. L.¹, I.S. EISSA¹, A.D.M. YOUSEF¹ AND R.A.H.MOHAMED²

1. Economic Entomology, Plant Protection Department, Fac.Agric., Al-Azhar Univ.

2. Sector of Production, ARC, Giza

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Abstract

The effect of pollen substitutes feeding on the activity of honeybee was investigated including two races: Fl Carniolan and Fl Italian honeybee. Some food materials of high protein, sugar, vitamins and minerals content locally available were used to increase colony population, pollen collection as well as honey and royal jelly production. The pollen substitutes were: A (chick pea), B (soybean). The results showed that there were no significant differences between honey productions in the two tested, races. The data showed that there was a significant differences between two treatment, A and B of Carniolan colonies, when the pollen gathering was studied, whereas there was no significant difference between all treatments in case of Italian colonies. There was a significant difference in royal jelly production among the tested pollen substitutes hives treatment of Carniolan and Italian colonies, while there were a significant differences between the two treatments in food consumption in the two-tested races in summer season.

INTRODUCTION

Supplementary feeding was developed by many investigators in order to increase the number of workers in the colony whenever needed to improve the productivity of commercial apiaries. Pollen, nectar and water are the usual diet of honeybee (Free, 1957). During a dearth period the number of bees colonies may decrease, adversely affecting the production of honey in the following season. Pollen substitute are often used to produce package bees, queens, and increase the number of foraging bees (Stanger & Laidlaw, 1974). Haydak (1967) found that soybean, dry milk and soybean flour makes adequate pollen substitute, but not equal pollen as feed bees. To overcome the shortage of pollen and nectar during the dearth period, various diets are provided as pollen substitute. A pollen substitute suggested by Steve (1981) consists of soybean flour (55%), sugar (25%), soybean (5%), milk powder (5%) and water (10%). There are various supplementary diets advocated and commercially available, but most appear to be variously nutritionally poor or

unpalatable and are not well tested. Based on the principles of dietetics (Carter, 2003 and Anonymous, 2003). Pollen substitute have the ability to enhance the performance of honeybee colonies .Therefore, the following study was designed to measure the effect on royal jelly, honey and pollen production, when honeybees were fed a pollen substitutes.

MATERIALS AND METHODS

The present study was performed during two successive years (2004&2005) in 3 seasons (1/4-28/5 spring,1/6-28/7 summer and 1/8-27/9 late summer) in the apiary of the Faculty of Agriculture in Al-Azhar University at Mustored farm. Two races of honeybee (*Apis mellifera*) colonies were used, 1st hybrid of Carniolan and Italian bees. Twelve colonies of honeybee almost equal in strength were selected. The colonies were divided into two equal groups. Each group contains 6 colonies to evaluate the different feeding treatments (diets). Frontal pollen traps were fitted to the entrances.

Preparation of pollen substitutes:

Two pollen substitutes A and B were prepared as: A contains 30% Soybean flour, 30% skimmed milk, 30% Sugar and 10% yeast where as B contain 30% Soybean flour, 30% skimmed milk, 30% Sugar and 10% yeast. Several food stuffs containing considerable amounts of protein and available in cheap price in the local market were chosen for this study. Flours of this stuff were sifted using different sieves of sifts with different mesh. Thereafter, they were mixed with sucrose solution (1:1 w/v) making a cakes. The cakes were spread on a plastic sheet. It was left for 24 hours to be little pit dried, then divided into small pieces (30 g./ colony). The cake was provided to each colony at 3 days interval all the experimental period. The cake was placed directly over the brood nests covered with plastic sheets to avoid drying.

Estimation of food consumption:

Each colony received each there days 30 g. of tested diets during the experimental period during 1/4 -29/5, 1/6 -28/7 and 1/8 -25/9 throw two years (2004 and 2005) at spring, summer and late summer seasons, respectively. The unconsumed diets were collected and weighed to determine the rate of consumption of each diet. The colonies were fed only with 500 ml sucrose solution.

Royal jelly measurement:

The grafting technique was followed by chosen larva for transferring and queen cell cups from bee wax, fifteen cell cups were fixed on a wooden bar, using melted wax and bars were fitted into a frame and grafting the larvae and inserted into quenelles colony. After 3 days from each grafting the collection of royal jelly was

processed by a small wooden stick after removing the larvae and the royal jelly collected was weighted (g/3 day/colony) for every treatment.

Pollen production:

Pollen were collected through the experimental period as orbicular pellets removed from the pollen basket on the bees hind legs as they passed through pollen traps attached to honeybee hives. The trapped pollen was collected from the pollen traps daily throughout the experimental period. The weight of fresh pollen was determined and recorded.

The honey production was estimated by total honey weight extracts.

RESULTS AND DISCUSSION

Colonies were usually fed substitute foods for one or more of the following reasons:

To ensure continued colony development in places and times of shortage of natural pollen and nectar.

1. To develop colonies with optimum populations in time for nectar flows.
2. To build colonies to high populations for queen and package-bee production.
3. To provide adequate food reserves for overwintering colonies.

The effect of pollen substitutes on food consumption

The results of the feeding preference comparisons between the pollen substitutes on the food consumption are shown in (Table, 1). The higher pollen supplement consumption by honeybee in spring, 2004 was recorded by Italian honeybee (20.62 and 19.54/g diet) in the two treatments A and B, respectively. In contrast, the higher pollen supplement consumption was recorded by honeybee Carniolan in spring, 2005 (22.29 and 21.82 g./diet) for A and B, respectively. In summer, 2004 the higher pollen supplement consumption was recorded by honeybee Carniolan (24.01 and 21.07 g./diet) while in summer season, 2005 the higher pollen supplement consumption was recorded by Italian honeybee (24.16 and 18.59 g/diet) in two treatments (A&B), respectively. On the other hand in late summer, 2004 the highest pollen supplement consumption was recorded by Italian honeybee (17.72 and 16.52 g. /diet) in the two treatments (A&B), respectively, while in late summer, 2005 The highest pollen supplement consumption was recorded by Carniolan honeybee (19.13 and 10.55 g/diet) in two treatments (A&B), respectively. By using a test of multiple comparisons (L.S.D.), it was apparent that there was no significant differences between the two treatment hives of food consumption in both races Carniolan and Italian colonies in spring and late summer season during the two years, whereas

there were significant differences among the two treatments, in summer season during the two years in both races. Rogala and Szymas (2004) found that supplementing pollen substitute with lacking amino acids to bring them up to the pollen level caused the nutritional value of the protein in the surrogate to equal that of pollen. When fed to bees, the substitute gave similar dry matter, protein and crude fat contents of bee bodies. The present results indicated that the newly diet and pollen were equally accepted by the bees, as highly palatable as natural pollen and easily provided as patties to colonies.

The effect of pollen substitutes on honey production

Table (2) showed that the honey bee Italian colonies were the highest honey producer in summer season, 2004 (8.84 and 7.25 kg/ 3 colony) in the two treatments (A&B), respectively, or in summer, 2005 was 9.58 and 6.53 kg/3 colony. By using a test of multiple comparisons (L.S.D.), it was apparent that there was no significant differences between the means of the two treatments (A and B) hives in case of honey production. in both races of honeybee colonies at three seasons, in two years. These results were in agreement with Abdellatif *et al.* (1971), Atallah (1975), Eweis and Ali(1980) and Abd Al Fattah & EL-Shimy (1989) showed that in colonies given pollen supplement (soybean , chick pea, sugarcane syrup glucose, port lane and herring fish meal) honey produced was significantly greater than that of unfed ones. Abbas *et al.* (1995) found that colonies, which fed with pollen substitute containing black gram produced a high number of frames, resulting in higher production of honey compared to those fed on meal containing soybean.

Table 1. Consumption of pollen substitutes by honeybee treated colonies during 2004 and 2005 seasons (g/diet).

season	year	Italian		Carniolan		L.S.D	F
		A	B	A	B		
Spring	2004	20.62a	19.54a	18.56a	18.94a	Ns	1.213
	2005	21.97a	21.51a	22.29a	21.82a	Ns	0.043
Summer	2004	23.60ab	19.90b	24.01a	21.07ab	3.56	3.79
	2005	24.16a	18.59b	21.08b	17.81b	3.904	9.098
Late summer	2004	17.72a	16.52a	17.23a	14.71a	Ns	1.126
	2005	12.05a	10.65a	19.13a	10.55a	Ns	1.861

Table 2. Honey Production of pollen substitutes by honeybee treated colonies during 2004 and 2005 seasons (kg/colony).

Season	year	Italian		Carniolan		L.S.D	F
		A	B	A	B		
Summer	2004	8.84a	7.25a	7.7a	6.0a	ns	1.92
	2005	9.58a	6.53a	7.33a	6.38a	ns	1.65

The effect of pollen substitutes on pollen collection:

Table (3) demonstrates that the highest pollen collected by honeybee in spring 2004 were recorded by Italian honey bee (5.0 and 7.0 g/3 day/colony) in two treatments A and B, respectively. The same results were recorded in spring 2005 (4.48 and 11.92 g/3 day/colony). Further more the highest pollen collected in summer 2004 were recorded by Italian honeybee (3.72 and 8.19 g/3 day/colony) in addition in summer season 2005 the highest pollen collected was recorded by Italian honeybee (4.35 and 11.9 g/3 day/colony) in the two treatments (A&B), respectively. Same trend was recorded in late summer 2004 where the highest pollen collected by Italian honeybee recorded (1.19 and 0.6 g/3 day/colony) in the two treatments (A&B), respectively. Also, in late summer, 2005 the higher pollen collected was recorded by Italian honeybee (1.63 and 2.02 g/3 day/colony) in two treatments (A&B), respectively. By using a test of multiple comparisons (L.S.D.), there were significant differences between the two treatments of Italian colonies of pollen collection, in spring, summer and late summer seasons, in the two years. While there were non significant differences between them in case of Carniolan colonies in all seasons and years. The highest pollen collected by honeybee were recorded in spring and summer season in two treatments (A&B) by Italian and Carniolan colonies while in late summer it recorded the lowest value.

The effect of pollen substitutes on royal jelly production activity:

Table (4) show that the honeybee Italian colonies were the highest royal jelly production either in summer season, 2004 (1.73 and 1.40 g/3 day/colony), or in summer, 2005 (1.67 and 1.33 g/3 day/colony) in the two treatments (A&B), respectively. By using a test of multiple comparisons (L.S.D.), there was a significant difference between the mean values of the two treatments (A and B) hives in case of royal jelly production in both races of honeybee colonies at summer season, in the two years. In this respect, Atallah (1975) who showed that chickpea (cake or syrup) gave more brood, when used as pollen supplement in autumn. Nabors (2000) found

that package colonies of bees fed on pollen substitute upon installation in the spring were more productive than package colonies that were not fed a pollen substitute, it was also found that treated colonies produced more drawn comb, brood and more honey by the end of the honey flow.

Table 3. Pollen gathering of pollen substitutes by honeybee treated colonies during 2004 and 2005 seasons (g./ 3day/colony)

Season	year	Italian		Carniolan		L.S.D	F
		A	B	A	B		
Spring	2004	5.0ab	7.06a	3.63b	3.36b	2.77	3.962
	2005	4.48b	11.92a	3.74b	5.55b	4.23	0.028
Summer	2004	3.72b	8.19a	1.02b	1.68b	2.611	16.59
	2005	4.35b	11.9a	1.75b	2.44b	4.39	10.94
Late summer	2004	1.19a	0.6ab	0.23b	0.037b	0.883	2.07
	2005	1.63a	2.02ab	0.044ab	0.36b	1.67	3.51

Table 4. Royal jelly production of pollen substitutes by honeybee treated colonies during 2004 and 2005 seasons (g./ 3day/colony)

Season	year	Italian		Carniolan		L.S.D	F
		A	B	A	B		
Summer	2004	1.736a	1.406b	1.606a	1.276b	0.160	17.331
	2005	1.673a	1.330b	1.443b	1.116c	0.202	13.962

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دراسة تأثير بدائل حبوب اللقاح علي بعض الأنشطة لنحل العسل

أحمد لطفي عبد السلام^١ ، إبراهيم سليمان عيسي^١ ، عادل دياب محمد يوسف^١ ،
رمضان عطا حسن محمد^٢

١ - كلية الزراعة - جامعة الأزهر

٢ - قطاع الإنتاج بمركز البحوث الزراعية- جيزة

دراسة تأثير بدائل حبوب اللقاح علي الكمية المستهلكة من الغذاء:

أوضحت النتائج أن التفضيل الغذائي بين بدائل حبوب اللقاح علي الكمية المستهلكة من الغذاء أن أعلى معدل للكمية المستهلكة من الغذاء كان في أشهر الربيع خلال سنة ٢٠٠٤ وذلك في السلالة الإيطالية حيث وصلت الي ٢٠،٦٢ ، ١٩،٥٤ جم/تغذية وذلك في نوعي البدائل أ (حمص)، ب (فول صويا)، علي التوالي. كذلك، وجد أن أعلى معدل للكمية المستهلكة من الغذاء كان في أشهر الربيع خلال سنة ٢٠٠٥ وذلك في السلالة الكرينولي حيث وصلت الي ٢٢،٢٩ ، ٢١،٨٢ جم/تغذية وذلك في نوعي البدائل أ ، ب، علي التوالي. علي الجانب الآخر، أوضحت النتائج أن التفضيل الغذائي بين بدائل حبوب اللقاح علي الكمية المستهلكة من الغذاء أن أعلى معدل للكمية المستهلكة من الغذاء كان في أشهر الصيف خلال سنة ٢٠٠٤ وذلك في السلالة الكرينولي حيث وصلت الي ٢٤،٠١ ، ٢١،٠٧ جم/تغذية وذلك في نوعي البدائل أ ، ب ، علي التوالي، بينما في سنة ٢٠٠٥ وجد أعلى معدل للكمية المستهلكة من الغذاء كان في أشهر الصيف خلال سنة ٢٠٠٥ وذلك في السلالة الإيطالية حيث وصلت الي ٢٤،١٦ ، ١٨،٥٩ جم/تغذية وذلك في نوعي البدائل أ، ب علي التوالي. علي الجانب الآخر، في نهاية أشهر الصيف خلال سنة ٢٠٠٤ كان أعلى معدل للكمية المستهلكة من الغذاء في السلالة الإيطالية حيث وصلت الي ١٧،٧٢ ، ١٦،٥٢ جم/تغذية وذلك في نوعي البدائل أ ، ب ، علي التوالي، ووجد أن أعلى معدل للكمية المستهلكة من الغذاء كانت في نهاية أشهر الصيف خلال سنة ٢٠٠٥ وذلك في السلالة الكرينولي حيث وصلت الي ١٠،٥٥ ، ١٩،١٣ جم/تغذية وذلك في نوعي البدائل أ، ب علي التوالي.

دراسة تأثير بدائل حبوب اللقاح علي إنتاج العسل:

أوضحت النتائج أن في السلالة الإيطالية أعطي أعلى معدل لإنتاج العسل وذلك في أشهر الصيف خلال سنة ٢٠٠٤ حيث وصلت الي ٨،٨٤ ، ٧،٢٥ كجم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. بينما جاءت السلالة الكرينولي في الترتيب الثاني حيث وصلت الي ٧،٧،٦٠ كجم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. بينما في موسم الصيف ٢٠٠٥ أوضحت النتائج أن في السلالة الإيطالية أعطي أعلى معدل لإنتاج العسل وذلك في أشهر الصيف حيث وصلت الي ٩،٥٨ ، ٦،٥٣ كجم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. بينما جاءت السلالة الكرينولي في الترتيب الثاني حيث وصلت الي ٧،٣٣،٦،٣٨ كجم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي.

دراسة تأثير بدائل حبوب اللقاح علي جمع حبوب اللقاح:

أوضحت النتائج أن أعلى معدل لجمع حبوب اللقاح كان في سنة ٢٠٠٤ وذلك في السلالة الإيطالية حيث وصلت الي ٥،٠٠ ، ٧،٠٠ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. وتم الحصول علي نفس النتائج في أشهر الربيع ٢٠٠٥ بينما جاءت السلالة الكرينولي في الترتيب الثاني حيث وصلت الي ٤،٤٨ ، ١١،٩٢ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. أوضحت النتائج أن أعلى معدل لجمع حبوب اللقاح كان في سنة ٢٠٠٤ وذلك في السلالة الإيطالية حيث وصلت الي ٣،٧٢ ، ٨،١٩ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. وكانت نفس النتائج في أشهر الصيف ٢٠٠٥ بينما جاءت نفس السلالة في الترتيب الأول حيث وصلت الي ٤،٣٥ ، ١١،٩ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. كذلك في نهاية أشهر صيف ٢٠٠٤، أوضحت النتائج أن أعلى معدل لجمع حبوب اللقاح كان في سنة ٢٠٠٤ وذلك في السلالة الإيطالية حيث وصلت الي ٥،٠٠ ، ٧،٠٠ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. ونفس النتائج كانت في أشهر الصيف ٢٠٠٤ حيث أعطت السلالة الكرينولي أعلى معدل لجمع حبوب اللقاح وصلت الي ١،١٩ ، ٠،٦ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي.

وكانت نفس النتائج في نهاية أشهر الصيف ٢٠٠٥ حيث أعطت السلالة الإيطالية أعلى معدل لجمع حبوب اللقاح حيث وصلت الي ١،٦٣ ، ٢،٠٢ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي.

دراسة تأثير بدائل حبوب اللقاح علي إنتاج الغذاء الملكي:

أوضحت النتائج أن أعلى إنتاج للغذاء الملكي كان في سنة ٢٠٠٤ وصلت الي ١،٧٣ ، ١،٧٤ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي. وكانت نفس النتائج في أشهر الصيف ٢٠٠٥ حيث أعطت السلالة الإيطالية أعلى إنتاج للغذاء الملكي في سنة ٢٠٠٥ وصلت الي ١،٦٧ ، ١،٣٣ جم/٣ طوائف وذلك في نوعي البدائل أ ، ب، علي التوالي.