J. Plant Prot. and Path., Mansoura Univ., Vol. 6 (2): 255 - 268 , 2015

STUDIES ON ACTIVITY OF HONEYBEE IN COLLECTING AND STORING POLLEN GRAINS DURING SPRING AND SUMMER SEASONS

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ABSTRACT

Foraging activity of the honeybee (*Apis mellifera* L.) in pollen collection were studied during spring and summer, 2012. The quantity and quality of the collected pollen were investigated.

The obtained results showed that over spring and summer seasons, the highest amount of trapped pollen (240.07 gram/colony/week) were recorded on August, when temperature was 35.02° C and relative humidity was 52%, however the lowest amount (13.38 gram/colony/week) was in April with temperature of 25.42° C and relative humidity 51%.

Concerning foraging activity of the experimental bees over the day, the results showed that the highest amounts of trapped pollen was recorded in the period between 10-12 a.m with average 11.22 g./colony represented 30.31%of the total pollen collected over the day ,followed by the period between 8-10 a.m with average 9.39 g./colony represented 25.36% . While the lowest amount of the collected pollen was found in the period between 4-6 p.m with average 2.61 g./colony which represented 7.04% of the total collected pollen.

On the other hand, results revealed that there were 13 different floral sources of pollen over the two seasons at the region of the study, where bees collected pollen of *Zea mays* by the highest percentage (46.79%), followed by *Trifolium alexandrinum* (30.68%), then *Phoenix dactylifera* (19.00%), however *Cucurbita pepo* recorded the lowest percentage (1.44%) of the total collected pollen.

Concerning the effect of beebread components on production of the brood area, results indicated to increasing the content of crude protein and crude lipids of the stored beebread was associated with increasing of the brood area in spring, however in summer the brood area decreased with decreasing the crude protein and moisture.

Chemical analysis of the trapped pollen showed that pollen of *Helianthus annus* recorded the highest level of moisture, crude protein, ash, reducing sugar and pH, while *Phoenix dactylifera* pollen recorded the highest amount of crude lipids and the lowest amount of ash and pH.

Keywords: Pollen, trapped pollen, stored pollen and daily activity.

INTRODUCTION

Pollen is one of the vital important components to honeybee and so to beekeeper. It is the only source of nitrogenous food for bee larva, brood rearing, and adult growth (Day *et al.,* 1990 and Loidl and Crailsheim, 2001). The absence of pollen surly leads to the extinction of the colony. Pollen is not only the mean source of protein but also source of amino acid and provides vitamins, minerals, and fats (Roulston *et al.,* 2000) that essential for

the development of brood and young adult bees. Honey bee collected a large quantity of pollen from different crop over the year, but pollen gathering activity depending on some factors such as race of honey bee, honey bee health, environment conditions and planting area around the honey bee colonies, …… etc.

The honey bee collected different types of pollen irrespective of their protein content but it may be depend on other factors such as volatile component, colony status and color. The plant source of pollen can often identified from the color of the pollen loads and almost 0.01% of all pollen loads are color mixed (Stanley and Linskens, 1974).

Collection of the high quality pollen for later feedback to bees is possibly the start step to a bee's nutrition management program. The use of pollen traps, deep freezes and feedback techniques could allow better honey production, better queen bee breeding and greater profits from a bee farming business.

Trapping incoming pollen can greatly help in studying foraging activities of bees and for identifying and classifying pollen sources at given location. On the other hand, storing pollen is as basic ingredient of a pollen supplement for feeding bees.

Hansen & Korie (2000) developed a method to evaluated hourly pollen release in typical pollen flower. The plant families that contributed the largest number of pollen species were Fabaceasa, Asteraceae, Boraginaceae, Convolvulaceae, Euphorbiaceae, Sapindaceae, Poaceae, Myrtaceae, Sapotaceae and Tilaceae (Villanueva 1999).

Therefore, the present work was aimed to study pollen-gathering activity of the honeybee colonies under prevailing local environmental condition of Minia region, identification of the collected pollen, and making comparison study between chemical analysis of the collected and stored pollen (beebread) which affect brood rearing.

MATERIALS AND METHODS

The present study was carried out in a private apiary located in west of Abokorkas district, Minia governorate, during the period from March to end of August 2012, for comparison between amounts of the collected and stored pollen . Fifteen first hybrid Carniolan honey bee (*Apis mellifera* L.) colonies were used .The experimental colonies were in an equal strength (bees covered 8 wax combs) and headed with sister recently mated queens. Pollen trap (a wooden box, it has a slope roof and two vertical metal strips each 11 cm. in width and 32.5 cm in length. Each strip has hole of about 3 cm. in diameter, a slide wooden box (collection tray) 7 cm. in width, 30cm. in length fixed under the fine wire screen to collect pellets which fall from the workers legs when try to pass from the trap to the hive) was used for trapped the coming pollen. Efficacies of the used traps were checked before using and only that trap having efficacy over 98% was used. Nine pollen traps were used to trap the coming pollen by the forager workers of the experimental colonies. Each trap was fixed at the hive entrance of one of the experimental colonies for one day only and shifted to another colony in the next day. The

experimental colonies and the collected pollen were subjected to different measurements as follows:

1. Evaluation of pollen collection activity

Three measurements (daily, weekly and monthly) were taken into consideration to evaluate gathering activities of the experimental colonies as follows:

A- Daily activity of pollen gathering

On the day of the midmonth of every month over the activity seasons (from April to August 2012), the content of each fixed pollen trapped were taken over the day (from 8.00 a.m. to 6.00 p.m., at two hours intervals) and weighted. The average amount of the collected pollen for each studied time was calculated.

B- Weekly, monthly and seasonally of pollen collection rate

The pollen traps that fixed at the entrances of the experimental colonies (from March to August 2012) were daily inspected to get out their pollen content. The weekly and monthly rates of pollen collection were estimated over the two seasons. The collected amount were weighted and stored in airtighted container under freezing temperature until used. At the same time, weekly average of the maximum temperature and relative humidity were recorded over the study period.

2. Identification and classification of the trapped pollen

Different types of collected pollen during the experimental period were classified to different groups according to its color, and then each group, which represents one color, was weighted. The plants' source of each group was identified through preparing slides of each group and matching the obtained features with library pictures of pollen grains of different sources. The representative percentage of each pollen group out of the total collected pollen was estimated. Also, availability period of each pollen type over the study period was recorded.

3. Chemical analysis of the trapped and stored pollen

Yield of the trapped pollen was daily collected as mixture of different pollen types which stored in clean vials under freezing temperature (-18 ^{o}C) until further procedures. The collected pollen was classified through separation to different groups according to its color. Three samples (5 gr. each) of each pollen group represented a particular pollen type and other three samples of the accumulated harvested mixture pollen that represented a particular period (normally at 30 days intervals over spring and summer season) were got out. At the same time, three samples of the stored pollen were collected to represent the trapped pollen but in other feature (beebread). The collected samples were subjected to chemical analysis for identification of their chemical components. Chemical analysis of the trapped and stored pollen was carried out in laboratory of National Research Center, Cairo, Egypt to determine the following contents:-

A- Moisture:

It was determined by drying pollen samples to constant weight in an air oven at 60ºC, then percentage of moisture content was estimated. (Bell *et al.,* 1983).

B- Crud protein:

Crude protein content was determined, in duplicate, according to Domas methods (A.O.A.C , 2000). Total nitrogen content was determined using an elemental analysis (National Research Center), Calibrated against standards. Pollen sample (0.2 g) were weighted into a combustion boat, and combusted at 950 C. to determine total crude protein, nitrogen values were multiplied by a conversion factor of 6.25 (Roulston *et al.,* 2000**)**

C- Crud Lipids

Lipids content of the pollen samples were measured gravimetrically after extraction with petroleum ether through using a Soxilts lipids extraction apparatus. **(Bell *et al*.1983)**

D- Ash content:

It was measured through heating pollen samples in a muffle furnace at 450 ºC until a uniform gray-white ash remained. The samples were then weighted for estimation the average percentage of the ash content. (Bell *et al.,* 1983).

E- Reducing sugar

The content of the reducing sugars was determined according to the method reported by Gordon and Diane, (2002).

F- Crud fiber:

It was determined by following the standard procedures of A.O.A.C., (1995) and then representative percentage of fiber was estimated.

G- Level of pH

The pH levels of the collected samples were determined according to the procedures mentioned in A,O,A,C.,(1995) .

4. Effect of chemical components of different types of the pollen on brood rearing:

Change of the chemical components of the tapped pollen and the stored pollen (beebread) in a particular period was focused through comparison between each other. In addition, the relation between the brood area and the components of stored pollen was studied. To estimate the brood area during the experimental period, a typical Langstroth frame (19 inch in length and 7 inch in width) was divided into 133 square inches by means of wire. This frame was laid against any comb to measure the area of the sealed brood. The measurement was made at intervals of twelve days according to the method reported by Al-Tikrity et al. ,(1971).

5.Statistical analysis:

The obtained data were subjected to one-way analysis of variance and the differences among means of the treatments were compared according to least significant range test (Duncan range) according to methods reported by Mead *et al.,* (1993).

RESULTS AND DISCUSSION

1. Evaluation of pollen collection activity

Determination of the daily, weekly, and monthly rate of pollen collection greatly helped in drawing a clear picture on pollen gathering activities of the honeybee colonies as follows:

A- Daily activity of pollen gathering

Data presented in Table (1) showed that the highest amounts of trapped pollen during the activity period was recorded at 10:12 a.m. with average of 11.22 g./colony, which represented 30.31% of the total amount of pollen collected over the day, followed by that amount collected at 8:10 a.m. with average 9.39 g./colony (represented 25.36%), then that collected at 12:2 p.m. with average 8.40 g./colony(represented 22.70%). On the other hand, results revealed that the amount of pollen collected at 2:4 p.m. occupied the fourth rank with average of 5.40 g./colony which represented 14.59%, while the lowest amount of the collected pollen was recorded at 4:6 p.m. with average of 2.61 g./colony represented 7.04%. The obtained results may close to those results reported by Awad, (1998) who found that in summer the bees collected the highest amount of pollen at 10:12 p.m., while in spring the highest amount was at 8:10 a.m.

Table (1): Average amount of the pollen (g. /colony) collected by experimental honeybee colonies over the day hours at Abokorkas district, Mina governorate during season 2012.

Date	Pollen collection timing over the day				
	8:10 a.m.	10:12 a.m.	12:2 p.m.	2:4 p.m.	4:6 p.m.
15th March	3.25	5.02	5.98	1.05	0.00
15th April	3.23	6.15	5.16	3.05	0.85
15th May	6.05	14.40	8.57	4.51	1.84
15th June	13.64	11.20	7.26	4.15	2.23
15th July	11.05	13.40	9.95	7.13	2.45
15th August	19.10	17.20	13.50	12.50	8.26
The general average (g./colony)	9.39	11.22	8.40	5.40	2.61
Duncan range at 5%	3.06				
Represented percentage %	25.36	30.31	22.70	14.59	7.04

B- Weekly, monthly and seasonally of pollen collection rate

Results tabulated in Table (2) showed that the first week of March recorded the highest amount (30.11 g./colony) where temperature was 24.34 ° C and relative humidity was 55%, while first week of April recorded the lowest amount (13.38 g./colony) at 25.42 ° C and relative humidity 51% in spring season.

Concerning summer season, results in the same Table revealed that the highest amount of trapped pollen was recorded August particularly in the third week (240.07 g./colony), however, the lowest amount of the trapped pollen was recorded in June exactly in the third week(16.71g./colony) where

average temperature and relative humidity were 35.02 ° C and 52%, and 35.74 ° C were 51 % and, respectively.

In general, the obtained results revealed that the experimental colonies collected more quantity of pollen (1357.66 g./colony) in summer season more than four times that amount collected in spring season (279.1 g./colony)

Table (2): Weekly, monthly, and seasonally average of the trapped pollen (g./colony) under temperature and relative humidity conditions in Spring and Summer season (2012) of Minia governrate.

Date	Month	Season	Average of trapped pollen (gr. /colony)	Average of the maximum temperature	Average of Relative humidity (%)
1/3/2012	March	Spring	30.11	24.34	55
8/3/2012			20.07	24.77	48
15/3/2012			20.06	28.49	51
22/3/2012			21.76	25.48	58
29/3/2012			20.06	28.31	54
Monthly average			112.06	26.28	53.20
5/4/2012	April		13.38	25.42	52
12/4/2012			13.36	26.74	48
19/4/2012			15.04	28.67	53
26/4/2012			13.40	31.85	42
Monthly average			55.18	28.17	48.5
3/5/2012	May		26.73	38.39	34
10/5/2012			25.03	30.65	34
17/5/2012			21.73	30.60	50
24/5/2012			20.00	38.99	32
31/5/2012			18.37	36.93	39
Monthly average			111.86	35.112	37.8
Spring season average			279.1	29.97	46.36
7/6/2012	June	Summer	20.04	38.08	42
14/6/2012			18.40	34.60	42
21/6/2012			16.71	35.74	51
28/6/2012			43.41	33.59	42
Monthly average			98.56	35.50	44.25
5/7/2012	July		45.05	34.81	50
12/7/2012			48.40	38.88	43
19/7/2012			66.83	43.83	43
26/7/2012			66.74	38.42	53
Monthly average			227.02	38.99	47.25
2/8/2012	August		176.74	40.10	44
9/8/2012			180.17	43.10	43
16/8/2012			240.07	35.02	52
23/8/2012			220.03	35.50	57
30/8/2012			215.07	35.93	58
Monthly average			1032.08	37.93	50.80
Summer season average			1357.66	37.51	47.69

2. Identification and classification of the trapped pollen

Identification of different floral sources of the collected pollen showed that there were 14 different floral sources (Table 3). In spring season 11 floral source were identified, where *Trifolium alexandrinum* presented by the highest percentage (30.68%), however *Cucurbita pepo* contributed by the lowest percentage (1.44%).

On the other hand, data in the same Table revealed that there were three floral sources only (*Zea mays, Sesamum indicum*, and *Helianthus annus*) represented most of the pollen trapped in summer season. Maize (*Zea mays*) pollen presented by the highest percentage (46.79%), followed by *Sesamum indicum* (11.22%), while the lowest percentage was belong to *Helianthus annus* (8.24%).

Table (3) Percentages of pollen types in difference seasons

Common name	Scientific name	Represent percentage out of the total collected pollen	Collection period
Egyptian clover	Trifolium alexandrinum	30.68	Spring
Date palm	Phoenix dactylifera	19.00	Spring
Ziziphus	Zizyphus spina Christi	17.00	spring
Lentil	Lens culinaris	11.44	Spring
Citrus	Citrus spp	6.23	Spring
Banana	Musa SP	5.56	Spring
Turnip	Brassica rapa	3.94	Spring
Cucumber	Cucumis sativus	2.04	Spring
Cauliflower	Brassica oleracea	1.86	Spring
Zucchini	Cucurbita pepo	1.44	Spring
Maize	Zea mays	46.79	Summer
Sesame	Sesamum indicum	11.22	Summer
Sunflower	Helianthus annus	8.24	Summer

3. Effect of chemical component of different types of stored pollen on brood rearing

In spring season, data of Table (4) showed that the trapped pollen got a remarkable change when it stored in the wax comb as beebread, where levels of moisture, crud protein, and reducing sugars increased significantly than those found in their corresponding trapped pollen. These levels were; 26.09, 23.82 and 26.67% in comparison to 21.29, 20.97, and 21.82 % for beebread and trapped pollen, respectively. On the other hand, the chemical analysis of both features of pollen showed that trapped pollen possess much significant quantity of both ash (2.64%) and crud fiber (7.15%) than beebread (1.62%) and (5.32%), respectively.

Concerning the effect of beebread components on production of the brood, results in Table (4) indicated to increasing the content of crude protein and crude lipids of the stored beebread was associated with increasing of the brood area.

In summer season, result of Table (5) showed the same trend noticed in spring season, where levels of moisture, crud protein, and reducing sugars were detected in much significant quantities in stored beebread than trapped pollen. They were, 26.46, 26.50, and 27.85 % in the stored beebread, in comparison to 23.12, 23.55, and 24.08% in the trapped pollen, respectively. However, reverse was recorded in case of ash content, where it was 3.16% in the trapped pollen, while it was 2.09% in the stored beebread. Also, the obtained data confirmed that increasing moisture and crude protein supported increase the brood area over summer.

4. Chemical analysis of different types of the trapped pollen

The pollen trapped in spring or summer season were subjected to the chemical analysis as follows:

A- The chemical analysis of the spring tapped pollen

Data tabulated in Table(6) showed much variation in moisture content of the trapped pollen, where highest level (23.08%) of moisture was found with *Brassica rapa* pollen, while the lowest one (18.98%) was detected with *Citrus spp* pollen.

Concerning crude protein, results of the same table revealed that crude protein content ranged between 17.63 to 22.31%. *Abelmoschus esculentus* pollen occupied the first rank (22.31%), while *Musa sp* pollen recorded the last one (17.63 %).

The current results may coincide with those results reported by Saa-Otero *et al.,* (2000) who stated that protein content in the pollen of the individual taxa varied between 14.0% and 29.6%, while (Almedia *et al.,* 2005) founded that pollen had average of 20% protein.

In the same context, results indicated that the crude lipids content of the trapped pollen was detected in *Phoenix dactylifera* pollen by the highest percentage (5.18%), followed by *Cucurbita pepo* (5.08 %), while the lowest percentage (3.41%) was found in *Trifolium alexandrinum* pollen.

These results are not close to those results reported by Almedia *et al.,* (2005) who found that pollen collected in Brazil had an average of 6% lipids.

Determination of ash content of the studied pollen samples showed significant differences among the pollen types (Table 6), *Lens culinaris* pollen possessed the highest content of lipids (3.16%), while *Phoenix dactylifera* pollen recorded the lowest percentage (1.35%).

These results are some how in agreement with Funari *et al*.,(2003) who found that the ash content of the fresh pollen ranged between 2% and 6% ,and also Alemdia *et al.,*(2005) who found that pollen had an average of 2.2% ash.

With concerning reducing sugars content, the obtained data revealed that the highest percentage (24.22%) of reducing sugars was found with *Citrus spp* pollen, followed by *Cucurbita pepo* (24.00 %), then *Abelmoschus esculentus* (23.82%), while the lowest percentage (19.52%) was detected in *Zizyphus spina Christi* pollen.

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These finding are not close to the results of Serra-Bonveh *et al.,*(1986) who analyzed a total of 31 pollen samples, and found that percentages of reducing sugars in the tested pollen types ranged between 52 to 56% .

With regard to the crude fiber content of the analyzed types of pollen, results of same table (Table 6) indicated that *Lens culinaris* pollen recorded the highest percentage of crud fiber (7.33%), while *Brassica rap*a pollen recorded the lowest one (6.06%).

The obtained data are not close to that data reported by Funari et al.,(2003) who determined the chemical composition of pollen collected by Africanized honeybee (*Apis mellifera scutellata)* in the Botucatu region, Sao Paulo State, Brazil, and found that the mean crude fiber in fresh pollen was 1.1%.

With relation to pH levels of the trapped pollen, results of Table (6) revealed that pH levels of the analyzed pollen could be arranged in the following descending order : 4.62, 4.32, 4.31, 4.23, 4.21, 4.18, 4.13, 4.09 and 4.00 for, *Trifolium alexandrinum*, *Brassica rapa*, *Cucurbita pepo, Zizyphus spina Christi*, *Brassica oleracea*, *Musa sp*, *Citrus spp*, *Lens culinaris* and *Abelmoschus esculentus*, respectively **.**

B- The chemical analysis of the summer tapped pollen

Result of Table (7) referred to moisture levels of the analyzed types of the trapped pollen, where the highest percentage(26.71%) of moisture recorded with *Helianthus annus* pollen, and the lowest one (20.09%) was found with *Sesamum indicum* pollen.

With regard to crude protein content of the analyzed types of pollen, results of the same table indicated that *Zea mays* pollen having the highest percentage (26.52%) of the crud protein , while *Cucumis sativum* pollen recorded the lowest one (20.13%). Protein levels of the other trapped types of pollen came in between the two levels mentioned above. These results may on line with those results reported by Saa-Qtero, *et al.,* (2000) who stated that protein content in the pollen of the individual taxa varied between 14.0% and 29.6%.

It also clear from results of Table (7) that the highest percentage (5.11%) of crude lipids was detected in the pollen of *Helianthus annus*, followed by *Cucumis sativus* pollen (4.31 %) ,while the lowest percentage (3.41%) was found in *Trifolium alexandrinum* pollen. These results are far from those results reported by Almedia *et al.,* (2005) who found that pollen collected in Brazil had an average of 6% lipids.

In the same season, results of Table (7) showed much variation in ash content of the trapped pollen ,where it ranged between : 4.08 to 1.63% for *Helianthus annus* and *Trifolium alexandrinum*, restively.

Concerning reducing sugars content, results of Table (7) showed a wide range of percentages of these sugars. Percentages of the reducing sugar of the studied pollen could be arranged in the following ascending order; 19.52, 20.01, 22.18, 22.32, 24.31 and 27.08 for *Zizyphus spina* Christi, *Trifolium alexandrinum*, *Cucumis sativus*, *Sesamum indicum, Helianthus annus* and *Zea mays*, respectively.

6-7

However, as seen from Table (7) there were narrow variations in crude fiber contents of the trapped pollen, where the highest percentage (7.22%)was recorded in the pollen of *Helianthus annus*, then *Zea mays* (7.15%), while the lowest percentage (6.26%) was found with *Trifolium alexandrinum* pollen.

On the other hand ,results in Table (7) showed that determination of pH of the trapped pollen types showed very close levels of the analyzed pollen types, where *Helianthus annus* pollen record the highest level (4.67), while the lowest one (4.22) was recorded for the pollen of *Sesamum indicum*. Levels of pH of the other trapped pollen came in between the two levels mentioned above.

It could be concluded that the bee foragers collected the highest amounts of pollen at 10-12 a.m., followed by 8:10 a.m, then 12:2 p/m, then 2:4 p.m, while the lowest amount was at 4:6 p.m. The highest amount of trapped pollen over the experimental period recorded in August, followed by July, March, May, June, and April. *Zea mays* recorded pollen represented the highest percentage of different floral sources, while Cucurbita pepo recorded the lowest percentage. Concerning the effect of beebread components on production of the brood, results indicated to increasing the content of crude protein and crude lipids of the stored beebread was associated with increasing of the brood area in spring, however in summer the brood area decreased with decreasing the crude protein and moisture. Chemical analysis of the trapped pollen showed that pollen of *Helianthus annus* recorded the highest level of each moisture, crude protein, ash, reducing sugars and pH, while *Phoenix dactylifera* pollen recorded the highest amount of crude lipids and the lowest amount of ash and pH.

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دراسات على نشاط نحل العسل في جمع وتخزين حبوب اللقاح خلال موسمى الربيع والصيف

عادل رشدي حسن * ، حسن محمد فتحي ** ، محمد حسن بيومي **

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*** قسم وقاية النبات – كلية الزراعة – جامعة المنيا – مصر**

**** قسم الحشرات الاقتصادية – كلية الزراعة – جامعة المنصورة – مصر**

تم دراسة نشاط سروح طوائف نحل العسل (*Apis mellifera* L.) في جمع حبوب اللقاح خلال فصلي الربيع والصيف لعام 2012 حيث أقيمت التجربة في منطقة تقع غرب مركز ابو قرقاص بمحافظة المنيا وذلك باستخدام 15 طائفة نحل كرنيولى هجين، حيث تتوافر مصادر جيدة من النباتات ذات حبوب اللقاح المفضلة للنحل. كانت طوائف النحل مزودة بمصائد حبوب اللقاح على مداخل الخلايا لاصطياد حبوب اللقاح القادمة في أرجل النحل السارح. ونم تسجيل درجة الحرارة والرطوبة النسبية السائدة خلال فترة الدراسة. كما تم تحليل مختلف حبوب اللقاح المتحصل عليها من خلال المصائد او تلك المحزنة في الأقراص الشمعية) خبز النحل) ودراسة تأثير مكونات تلك الحبوب لإنتاج الحضنة في طوائف نحل العسل المستخدمة

وأظهرت النتائج ما يلي:

جمع النحل أكبر كمية من حبوب اللقاح (240.07 جرام / طائفة / الأسبوع) في الأسبوع الثالث من شهر أغسطس حيث كانت درجة الحرارة 35.02 درجة مئوية والرطوبة النسبية 52 % ، بينما جمع أقل كمية

(13.38جرام / طائفة / الأسبوع) في الأسبوع الثالث أيضا من شهر ابريل حيث كانت درجة حرارة 25.42درجة مئوية والرطوبة النسبية 52٪.

وفيما يتعلق بنشاط سروح النحل على مدار اليوم، أظهرت النتائج أن أعلى كمية من حبوب اللقاح جمعها النحل في الفترة ما بين 10-12 صباحا بمتوسط 11.22 جرام/طائفة والتي تمثل 30.31 % من مجموع ما جمع على مدار اليوم، تلتها الفترة 8- 10 صباحا بمتوسط 9.39 جرام / طائفة والتي مثلت 25.36٪ .بينما كانت أقل كمية من حبوب اللقاح جمعها النحل في الفترة ما بين 4-6 مساءا بمتوسط 2.61 جرام /طائفة والتي مثلت 7.04% من مجموع ما جمع على مدار اليوم.

ومن ناحية أخرى، كشفت النتائج أن هناك 13 مصدر نباتي مختلف من حبوب اللقاح على مدى موسمي الدراسة، حيث كانت حبوب لقاح الذرة الشامية تمثل أكبر كمية مجموعة على مدار الموسمين وكانت نسبتها (46.79%) ، تلتها حبوب لقاح البرسيم المصري بنسبة (30.68%) ، تلتها حبوب لقاح النخيل بنسبة (19.00%) ، بينما كانت حبوب لقاح الخيار أقل نسبة مئوية (1.44%).

بالنسبة لتأثير التركيب الكيميائي لخبز النحل على مساحة الحضنة المنتجة فقد أشارت النتائج إلى زيادة مساحة الحضنة بزيادة محتوى البروتين الخام والدهون الخام في خبز النحل المخزن في فصل الربيع، ولكن في الصيف انخفضت مساحة الحضنة م ع انخفاض محتوى حبوب اللقاح المخزونة من البروتين الخام والرطوبة.

وأظهر التحليل الكيميائي لحبوب اللقاح المجموعة أن حبوب لقاح عباد الشمس سجلت أعلى مستوى من كل الرطوبة، والبروتين الخام، والرماد، والسكريات المختزلة، ودرجة pH، في حين سجلت حبوب لقاح النخيل أكبر قيمة للدهون الخام وأقل قيمة للرماد ودرجة pH .

Table (4): Effect of stored pollen components on production of the brood by colonies of the hybrid Carniolan bee, *Apis mellifera* L. over spring season at Abokorkas district, Minia governorate, 2012

The chemical components (%)	Period from16/3/2011 to 12/4/2012		Period from 13/4/2012 to 4/5/2012		Period from 5/5/2012 to 26/5/2012		Period from 27/5/2012 to 17/6/2012		Mean		T value at 5%
	Mixture of the trapped pollen	The stored beebread	Mixture of the trapped pollen	The stored - beebread	Mixture of the trapped pollen	The stored beebread	Mixture of the trapped pollen	The stored beebread	Mixture of the trapped pollen	The stored beebread	
Moisture	22.15	27.15	21.08	26.15	21.00	25.33	20.94	25.71	21.29	26.09	28.7*
Crude protein	21.09	23.09	21.11	24.18	20.55	23.02	21.11	25.00	20.97	23.82	7.02*
Crud lipids	4.62	3.81	4.52	3.82	4.61	3.41	4.00	4.08	4.44	3.78	2.86
Ash	2.19	1.66	2.82	1.50	2.71	1.63	2.82	1.67	2.64	1.62	5.97*
Reducing sugar	21.93	26.93	21.91	27..00	21.63	26.31	21.81	26.42	21.82	26.67	41.56*
Crude fiber	7.00	5.89	7.15	5.08	7.13	5.11	7.32	5.21	7.15	5.32	7.62*
Brood area (sq. inch/colony)	201.15		222.05		195.11		370.03				

***Difference between means is significant at 5%**

Table (5): Effect of stored pollen components on production of the brood by colonies of the hybrid Carniolan bee, *Apis mellifera* L. over summer season at Abokorkas district, Minia governorate, 2012

The chemical components	Period from 18/6/2011 to 11/7/2012		Period from 12/7/2012 to 4/8/2012		Period from 5/8/2012 to 26/8/2012		Period from 27/8/2012 to 18/9/2012		Mean		T value at 5%
	Mixture of the trapped pollen	The stored beebread	Mixture of the trapped pollen	The stored beebread	Mixture of the trapped pollen	The stored beebread	Mixture of the trapped pollen	The stored beebread	Mixture of the trapped pollen	The stored beebread	
Moisture	23.08	24.57	23.19	26.11	23.08	27.14	23.11	28.00	23.12	26.46	4.53*
Crude protein	23.88	25.89	23.98	26.13	23.11	26.88	23.24	27.11	23.55	26.50	5.86*
Crud lipids	3.89	3.71	4.01	3.81	4.16	3.11	4.17	3.21	4.06	3.44	2.28
Ash	3.17	2.08	3.22	2.11	3.11	2.00	3.12	2.17	3.16	2.09	27.57*
Reducing sugar	23.81	28.09	23.91	28.00	24.00	27.11	24.61	28.19	24.08	27.85	14.28*
Crude fiber	7.08	5.09	6.87	6.01	5.08	5.04	5.18	5.36	6.05	5.38	1.52
Brood area (sq.inch/colon)	216.07		255.12		319.00		390.01				

***Difference between means is significant at 5%**

Table (6): Chemical components of the trapped pollen collected by colonies of the hybrid Carniolan bee *Apis mellifera* L. over spring season (2012) at Abokorkas district, Minia governorate

Plant source of the pollen		Chemical components						
Common name	**Botanical name**	**Moisture**	**Crude protein**	**Crude lipids**	**Ash**	**Reducing sugar**	**Crude fiber**	**pH**
Citrus	*Citrus spp*	18.98	18.51	4.18	1.82	24.22	6.18	4.13
Banana	*Musa sp*	20.18	17.63	4.32	2.79	23.18	7.12	4.18
lentil	*Lens culinaris*	22.08	22.18	4.00	3.16	20.19	7.33	4.09
Ziziphus	*Zizyphus spina Christi*	21.08	20.91	4.11	2.82	19.52	6.81	4.23
Turnip	*Brassica rapa*	23.08	21.51	3.81	1.93	20.11	6.06	4.32
Cucumber	*Cucumis sativus*	21.32	20.13	4.31	2.82	22.18	7.00	4.32
Zucchini	*Cucurbita pepo*	19.56	21.22	5.08	1.93	24.00	6.19	4.31
Date palm	*Phoenix dactylifera*	22.56	20.22	5.18	1.35	23.00	6.26	4.00
Okra	*Abelmoschus esculentus*	20.88	22.31	4.92	2.74	23.82	7.08	4.00
Egyptian clover	*Trifolium alexandrinum*	22.08	20.53	3.41	1.63	20.01	6.26	4.62
Cauliflower	*Brassica oleracea*	22.69	20.77	4.10	2.14	20.08	7.22	4.21
Duncan range at 5%		0.36	N.S	N.S	N.S	0.38	0.26	N.S

Table (7) Chemical components of the trapped pollen collected by colonies of the hybrid Carniolan bee *Apis mellifera* L. over summer season (2012) at Abokorkas district, Minia governorate

Plant source of the pollen		Chemical components						
Common name	**Botanical name**	**Moisture (%)**	**Crude protein (%)**	**Crude lipids (%)**	**Ash (%)**	**Reducing sugars (%)**	**Crude fiber (%)**	**pH**
Egyptian clover	*Trifolium alexandrinum*	22.08	20.53	3.41	1.63	20.01	6.26	4.62
Sesame	*Sesamum indicum*	20.09	23.61	4.11	3.00	22.32	6.98	4.22
Ziziphus	*Zizyphus spina christi*	21.08	20.91	4.11	2.82	19.52	6.81	4.23
Sunflower	*Helianthus annus*	26.71	25.93	5.11	4.08	24.31	7.22	4.67
Cucumber	*Cucumis sativus*	21.32	20.13	4.31	2.82	22.18	7.00	4.32
Maize	*Zea mays*	21.33	26.52	4.00	3.42	27.08	7.15	4.31
Duncan range at 5%		0.16	0.15	0.01	0.03	0.13	0.02	N.S