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EFFECT OF SUPER BOOST PHEROMONE AND NUTRITION ALTERNATIVES ON THE BEE BODY CONTENT AND BEHAVIOR OF POLLEN COLLECTION

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Abstract

An experiment was carried out to investigate the effect of nutrition alternatives and super boost on the average weight of pollen that collected by bee workers in the Faculty of Agriculture, University of Baghdad between 21 of February and the third of May 2017. The study of moisture content, protein, fat and minerals in the body of bees was done at the Central lab/ Faculty of Agriculture. Eighteen parcels were selected from the local strain, colonies were fed weekly and randomly distributed into six treatments (each treatment three colonies) included: T1 Chamomilepies, T2 pollen pies, T3 Chamomile pies with super boost pheromone T4 pollen pies with super boost pheromone, T5 super boost pheromone and T6 control. The results obtained by the present study detected that the average weight of pollen was the highest in T5 with a mean of 14.1g followed by T4, T2 with means of 10.454, 9.172, respectively. For body bee analysis, insignificant differences between treatments in terms of moisture content were noted while for the protein content, the highest value was 28.92 % in T2 compared to the lowest value in the T6 (control) with a mean of 22.48 %. The carbohydrate content and fat in T1 were 5.48, 4.72, respectively.

Key words : Protein content, carbohydrate content, pheromone, moisture content.

Introduction

Honey beesareliving organisms that need to nutritional requirements to continue, it is development and growth. Carbohydrates, amino acids, fats, vitamins, and minerals were the main requirements that must be proportioned to survival and growth (Huang, 2010). Honey bees are adopting their own grazing strategy and brooding according to the need of carbohydrates and proteins. Larvae and adults depend on food stock in the colony (Scimicckl Crailshiem, 2004) besides, colony nutrition plays an important role in strengthening the immune system. Brood breeding depends heavily on the value of the equipped proteins and beekeepers in general feed colonies with protein during the lack of pollen in pasture (Sagili and Breece, 2012). Alaux *et al*. (2010) pointed to a relationship between protein and the immunity in the beebody as protein deficiency increases the susceptibility to disease. Additionally, brood pheromones play a role in stimulating the effectiveness of pollen collectionand returning to the hive with more pollen. Brood easter pheromone was one of the brood pheromones that emitted at the end of the third phase and the beginning of the fourth phase of the age and it consists of ten ethyl esters of fatty acid (Pankiw and Page, 2001). Due to the pheromone importance, BC Inc Delta, Canada Enterprises Contech, companies produced a commercial product known as industrial brood pheromones or super boost. The addition of super boost to the honey bee colonies in the summer and spring made the bee workers inside the hive turn into wild workers at an early age, which increased the grazing to collect more pollen and led to rise the stock pollen inside the hive up to 150% (Pankiw and Sagili, 2009). Shaher and Naserella (2018) detected that using of super boost and nutritional alternatives increased each of brood area and collected pollen by recorded means of 192.857 inch^2, 14.1 g, respectively. However, there is a dearth of information and published scientific data on the effects of super boost and nutritional alternatives on the bee body content and the behavior of pollen collection. Therefore, the main goal of the current research was recognizing the behavior of pollen collection and the effect of nutrition alternatives on the bee body content of protein, fats, minerals and moisture.

Materials and Methods

Colonies configuration

In the present study, 18 local strainparcels identical in strength were selected. Three frames were covered with bees while one frame was covered by the brood, honey, and pollen in addition, the bee queens were vaccinated since spring 2015. The parcels were transported to wooden hives and all processes were carried out until the date of the experiment on 21 of February. The colonies were randomly distributed into six treatments (each treatment three colonies), were included:T1 feeding on chamomilepies, T2 pollen pies (Feed bee), T3 Super boost pheromone, T4 chamomilepies with super boost pheromone T5 pollen pies with super boost pheromone and T6 control. Colonies were fed weekly from 21 of February 2017 while the super boost was replaced every 35 days.

Preparation of pies

Pollen pies

The pollen (feed bees) was grinded using a household mill and amount of 150 g was taken and 75 g of sugar (sucrose) was added and mixed. After that a sugar solution 50% were prepared with 25 g of baking yeast, then a half of this mixture was taken, mixed with the previous ingredients and then paste. After that, 50 g of pie per colony was put on butter paper on the hive frames and the weight of consumed pie was weekly calculated.

Chamomile pies

Chamomile samples were collected in Abu Ghraib area during June 2016 and placed in a laboratory until they dried, then grinded and sifted. An amount of 100 g was taken from the grinded samples and 50 g of sugar (sucrose) was added and mixed. After that, a sugar solution 50% were prepared with 25 g of baking yeast then mixed with the previous ingredients and paste. After that, 50 g of pie per colony was put on butter paper on the hive frames and the weight of consumed pie was weekly calculated.

Super Boost Pheromone

Super Boost Pheromone was supplied by Canada company through it is representative in northern of Iraq and placed in freezer until use. A slice of pheromone has been put in each replicate of pheromone treatments and were replaced every 35 days as recommended by the company.

Measurement of pollen collecting activity

Pollen traps were placed in the hive door and for each treatment for 24 h/week and the collected pollen was weighed to investigate the effect of feeding and the pheromone on the activity of honey bee in pollen collecting.

Effect of nutrition on bee body content

After the end of the experiment, bee workers were moved at the age of 24 h by isolating bees with cages and were put in a freezer to be killed then transferred to the laboratory of Agriculture for the analysis after drying.

Determination of moisture content

The moisture percentage was estimated according to the Association of Official Analytical Chemist (A.O.A.C., 2005). An amount of 1 g of sample was dried in an oven at 105ºC for 16-24 hours and samples were left until the weight was stable and then weighed again. The moisture percentage was calculated using the following equation:

$$\text{Moisture percentage} = W1 - W2/W1 \times 100$$

Where, W1 - initial weight, W2 - sample weight after drying

Ash determination

The ash content was determined using a muffle furnace type Carolitc at 550ºC for 6 h and the used equation was:

$$\text{Ash \%} = (W2/W1) \times 100$$

Where, W1 - initial weight, W2 - ash weight after burning

Fat determination

The fat was extracted using the suxalite device and fats were calculated based on the following equation:

Hexane Extract (EE%) = (weight of fat extract / sample weight) × 100

Crude protein determination

Total nitrogen was measured according to the Association of Official Analytical Chemist (A.O.A.C., 2005).

Determination of carbohydrates

The carbohydrates was measured according to the Association of Official Analytical Chemist (A.O.A.C., 2005).

Statistical analysis

In the present study, the obtained results were analyzed by SAS software SAS, 2012 in a completely randomized design (CRD). Mean values and standard errors were detected, in addition, a comparison between the mean values was done by using the least significant difference test and $p < 0.05$ was considered statistically significant.

Results and Discussion

Average weight of pollen collected

Table 1 indicated that a significant difference between treatments was noted and the higher value was in T5 with a mean of 14.1 g/w followed by T4, T2, T3 with means of 10.454,9.172, 4.8g/w, respectively. However, the lowest value of the average weight of pollen collected was 3.5 g/w in T1 compared to T6 (2.1 g/w). This result was in agreement with previous outcomes that reported the addition of super boost pheromones to honey bee colonies in the summer and spring made the bee workers inside the hive convert to wild bee workers in an early age, which increases the effectiveness of pollen collecting and the stock pollen inside the hive recording 150% and consequently increased the growth of the colony (Pankiw, 2004). As for the time readings to increase the weight of pollen during the experimental period, an increase was noted with increasing the time period with the highest increase at the end of the experiment reached 17.4 g on the 2nd of May 2017.

Analysis of bee body content

1. The effect of feeding on pollen alternatives and super boost on moisture content of honey bee body

The obtained results of the present study showed a significant difference between treatments in moisture content in T2, T4 with means of 70.50, 70.23%, respectively compared with T6, which had a mean of 75.66%. It was noted that the less moisture content of bee body workers increased dry weight. However, in T1, T3 and T5 there were no significant differences between treatments compared with T6 were detected. It can be attributed that Sap coefficient in the bee body had a positive role in resistance of low temperatures, the lower sap coefficient, reflecteda greater tolerance for cold in the winter in addition, the nature of pollen and it is content of vitamins and minerals increases dry weight (Al Ghazali, 2008).

2. The effect of feeding on pollen alternatives and super boost on protein content of a honey bee body

Table 2 indicated that a significant difference between treatments in protein content was revealed. The higher values were in T2, T1 and T4 with means of 28.93, 28.72 and 28.14%, respectively. It may attributed to the high protein content in pollen (16.40%) and chamomile (13.11 %) in addition to the protein of baking yeast, which led to increase the protein content in the bee body due to the ability to metabolize food provided by protein –

Table 1 : The average weight (g) of pollen collected by wild bees in pollen traps for 24 hour/week.

Treatments	Average of pollen weight (g) during different time periods											Average
	21/2	28/2	7/3	14/3	21/3	28/3	4/4	11/4	18/4	25/4	2/5	
T1	0	0.5	4.3	4.3	6.0	4.2	1.7	4.8	1.7	7.2	3.8	3.500
T2	0	0.7	4.5	6.2	5.8	8.0	10.5	18	12.6	10.4	24.2	9.172
T3	0	0.7	0.7	3.2	2.0	5.0	5.3	6.5	6.7	9.3	13.4	4.800
T4	0	2.5	5.0	7.0	8.9	9.0	10	10.2	16.5	19.4	26.5	10.454
T5	0	2.2	3.5	4.6	8.6	10.4	16.7	21	25.5	30.1	32.5	14.100
T6	0	0.4	0.8	1.7	2.0	6.0	1.6	2.2	2.0	2.4	4.0	2.100
Average	0	1.166	3.133	4.5	5.55	7.1	7.633	10.45	10.833	13.133	17.4	—

T1 feeding on chamomile cookies; T2 pollen cookies; T3 Super boost pheromone; T4 chamomile cookies with super boost pheromone; T5 pollen cookies with super boost pheromone; T6 control.

Table 2 : Bee body content of moisture, dry matter, protein, carbohydrates, fat and organic matter.

Treatments	Moisture %	Dry matter %	Ash %	Fat%	Carbohydrate %	Protein %
T1	73.51	27.47	0.35	4.72	5.48	28.72
T2	70.50	29.49	0.49	3.71	5.12	28.92
T3	73.47	26.52	0.39	2.31	5.22	22.42
T4	70.32	29.68	0.60	1.04	4.50	28.14
T5	72.52	26.46	0.34	1.67	4.83	23.35
T6	75.66	24.33	0.23	1.72	3.85	22.48
LSD values	3.283*	2.914*	0.211*	1.376*	1.752 *	3.785*

T1 feeding on chamomile cookies; T2 pollen cookies; T3 Super boost pheromone; T4 chamomile cookies with super boost pheromone; T5 pollen cookies with super boost pheromone; T6 control.

digesting enzymes and ease of the absorption. Moreover, the natural pollen that collected by the bees consist of 13.50 %, which represent an additional source of protein. For T5, the protein content was similar to T6 and that depends on the role of pheromone in stimulating honey bee colonies to collect pollen from pastures in addition to the nutritional value of pollen sources in the study area which was characterized by a lack compared to the preparation of hives and the surrounding area with insufficient sources of pollen for natural feeding and pheromone alone.

3. The effect of feeding on pollen alternatives and super boost on carbohydrate content of a honey bee body

Carbohydrate proportion was higher in T1, T2 and T3 with means of 48.5, 5.12 and 5.22%, respectively, while T6 indicated the lowest value as a mean of 3.85% (table 2).

4. The effect of feeding pollen alternatives and super boost on the fat content of a honey bee body

Table 2 illustrated that a significant difference between treatments in fat proportion were noted. It was 1.72% in T6 while T1, T2 showed higher values as the mean of 4.7, 3.71%, respectively. However, T4 showed a decrease in fat content and the recorded value was 1.04%. The higher fat proportion in chamomile plant (2.61%) and the pollen (2.15%) was a possible reason for the mentioned decrease.

5. The effect of feeding on pollen alternatives and super boost on the ash content of a honey bee body

The highest value of the ash content was in T2, T3, T4 with means of 0.39, 0.49, 0.60%, respectively, while the ash content in T6 decreased to 0.39%. The current result can be attributed to the high nutritional value of these alternatives which have a key role in increasing the proportion of minerals in the body of honey bees.

6. The effect of feeding on pollen alternatives and super boost on the dry weight of a honey bee body

The highest dry weight in table 2 was for T2, T4 and T1, where it reached 29.68, 27.47, 29.49%, respectively, and the lowest weight was for T6 24.33%.

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