Effect of Feeding With Vitamins, Sugars and Pollen on The Biology of Honey Bee Apis Mellifera L. (Hymenoptera : Apidae) During The Autumn Season and The Use of Various Wintering Methods

Mohammed Shakir Mansor¹ Hijab Abd Jassim Al-Bajari² Mohmad Khalel Ibrahim³

¹,²Department of Plant protection, Faculty of Agriculture, University of Tikrit, Iraq.
³Department of Plant protection, Faculty of Agriculture, Al-Muthanna University, Iraq.

Email: mshmansor@tu.edu.iq

Abstract

The research included a study of nutrition with vitamins, sugars, pollen and some dispersal methods in from 5/7/2020 to 5/15/2021 to evaluate the nutrients and their effect on the open and closed brood space, honey area, pollen, eggs, the increase in cell weight, the quantity of honey produced as well as the number of packages of honey bee (Apis mellifera L) colonies. The results showed that feeding with vitamins, sugars and pollen has an important role in preparing the colonies before winter, as they passed it with strong colonies compared with the comparison treatment (without feeding) and with the highest numerical density in the nylon packing boxes treatment compared to the comparison treatment during the tenth month readings. The treatment of cork boxes in the fed colonies was distinguished in the production of immature honey compared to the control treatment. The results also showed the superiority of the colonies fed during the months of November and December 2020 with the same materials over the comparison treatment in bee density, open honey, sealed honey, pollen, eggs, larvae and sealed brood) compared to the control treatment. The fed and treated colonies passed some winterization requirements in good condition and gave the highest cell weights compared to the control treatment in mud boxes, sandwich boxes, wall coverings, cork boxes, and nylon packing. As for the production of sorted honey, the fed and dispersed colonies outperformed the fed and scattered colonies with treatments compared to the comparison treatment, and in the production of parcels, the comparison treatment did not produce any parcels, while the fed and dispersed colonies produced parcels.

Keywords: Vitamins, Sugars, Pollen, Apis mellifera, Colony.

1. Introduction

Honey bees have been known as one of the most important social insects since ancient times, and honey bee breeding and breeding is one of the most important branches of agricultural investment because it does not require large capital and brings good benefits to beekeepers, and many medical centers specialized in the treatment of bee products [1]. As 80% of cross-pollination contributes to the achievement by honey bees of field crops, fruit trees, vegetables and ornamental plants, where the amount of production increases by 25% [2]. Honey bee breeding does not require large capitals, high technical skills and expertise, and does not require advanced technological methods and techniques [3]. Somervill [4] mentioned that bee food is one of the important elements to strengthen it, as it provides necessary needs for its reproduction, growth and development, where pollen substitutes or food and nutrition supplements are provided by beekeepers at times of the year when food is less and bee swarms are reduced due to the lack of sources of pollen or nectar Or bad weather conditions or insufficient food in the cell, the bee hive needs 19.9 kg of pollen and 6.8 kg of honey during the seasons of the year, and that the development and growth of the larva until it turns into a full insect needs 100 mg of pollen [1].

Al-Zubaidi [5] mentioned that bees need carbohydrates, protein, water, minerals and fats like any living organism, as they obtain them during collecting nectar, pollen and water. The source of sugars is nectar, and the source of vitamins, proteins, fats and minerals is pollen. The hexagonal eyes are more than they need and consume it when needed when there are few or no sources of nutrition in the winter and summer, and thus the bee density decreases and the eggs decrease. Lack of food and
malnutrition make honey bees more deadly, and the immune system is more exposed to danger, which makes honey bees more susceptible to disease [6]. Due to the lack of food sources and the small area of vegetation cover and the need for bees for food to sustain the sect during the autumn and prepare it to cross the winter from the impact of low temperatures and lack of food. The study aimed to fill the bees' need for food in the autumn season and prepare them until they enter the winter season when they were strong. As well as distraction by several means during the winter season to preserve the colony and enter the season of activity while they are in healthy behavior.

2. Materials and Methods

2.1 Study site

The research was carried out in the researcher's apiary in Hawija district, which included fifteen colonies of hybrid Carniolan bees (Apis Mellifera L.). Parcels were prepared after dividing cells with the creation of parcels with new fertilized queens, that must be of one year old, it was selected with equal bee density and growth and the same number of tires and equivalent in the brood and the number of honey tires and pollen for the period from 5/7/2020 to 1/9/2020. The research included a study of nutrition with vitamins, sugars, pollen and some dispersal methods from 5/7/2020 to 15/5/2021 to evaluate nutrients and their effect on open and closed brood space, honey area, pollen, eggs, increase in cell weight and the amount of honey produced. As well as the number of parcels in honey bee colonies (Apis mellifera L.).

2.2 Selection of cells and installation at the study site

2.2.1 Selection of honey bee colonies

A total of 18 medium strength colonies of 5-6 bee-covered frames were selected from the local hybrid bee strain (Apis Mellifera L.) distributed at equal distances (1 m). Note that the floor of the apiary is level and symmetrically placed, directing the colonies’ openings towards the south, and they are compatible in bee density and strength, taking into account that they are free from Varroa mites, lice, pathogens and waxworm [7, 8]. The colony were distributed to 6 random groups, each group comprising three replicates that were randomly distributed inside the apiary. The apiary contains a canopy of fronds, and cans were placed under the feet of the sects’ bases in which water was placed to prevent ants from reaching it.

2.2.2 Queen

The colonies with modern queens were selected and vaccinated in the previous spring for research and are similar in external appearance, shape, size, activity, in the process of laying eggs and closed and open brood.

2.3 Cell nutrition

The cells were prepared by feeding them for a period from the tenth month until the first month to enter the winter season, and the following materials were used:

2.3.1 Feeding cells with sugar solution and vitamins

The experiment was conducted using water and sugar with different concentrations (depending on the mixing ratios of the sugar solution according to the research environment) in the 9th and 10th month 2 water 1 sugar in the 11th and 12th month. The concentration of the sugar solution was used in a ratio of 1:1: water: sugar. In the second month, a sugar solution was used in the ratio of 2 sugar: 1: water, and in the third month it was used in a ratio of 1:1: water: sugar. Vitamin PROBEELOVE (Figure 1) was added at a weight of 5 g per liter of the sugar solution and the solution was placed in an internal side food with a capacity of 1 liter and it was added to the cells except for the comparison without addition, and for each week the treatment was repeated (Table 1.).

| No. | Mixture type       | Ratios | Study months                      |
|-----|--------------------|--------|----------------------------------|
| 1   | Water + sugar      | 2 : 1  | December and October             |
| 2   | Water + sugar      | 1 : 1  | November, December and March     |
| 3   | Water + sugar      | 1 : 2  | February                         |
2.3.2. Feeding cells with pollen

Natural pollen grains were used, as they were collected by a pre-collecting pollen trap in a granular form, adding 50 g. to each cell on the frame adjacent to the brood frame every week. Then it is wiped by hand for the purpose of fixing it and an open brood frame was placed next to the frame in which the pollen was placed so that the brood was easily fed on the pollen and to make it easier for the queen to lay eggs in the pollen frame (Figure 2.).

2.4 Study the effect of treatments on bee activity of bee density, sealed and open honey, pollen, eggs, larvae and sealed brood

The experiment was carried out using a wooden frame divided into squares by thread, and the area of each square was Inches²

2.4.1 Studying the effect of different treatments on the activity of bees in the fall season

The experiment was conducted in the tenth, eleventh and twelfth months of 2020, and after a month of feeding, the wood frame was used to see the effect of different treatments on the activity of bees. The area of bee density, the quantity of sealed and opened honey, pollen, eggs, larvae and sealed brood for each hive was calculated by Inches² [9], and based on the method
[10], the area of the mentioned characteristics was calculated, where the area was measured by means of the wood frame and for each of the sides of the axis frame before [11] (Figure 3.).

Figure 3. The frame pivoted to a wooden device with two frames to measure the studied characteristics from both sides of the frame at the same time.

2.4.2 Study the effect of different treatments on cell weight, honey production and the number of packages in winter and spring

The experiment was conducted in the winter and spring seasons and the weight of the cells, honey production and the number of packages produced by each cell were calculated separately. The tires containing mature honey were taken out by shaking the frame containing the bees to remove it and the brush was used to clean the bees as well as in the (Figure 4) and from Then the honey was sorted using a Chinese-origin honey sorter to find out the most active treatment in collecting honey.

Figure 4. a frame honey frame before sorting, free of bees

2.5 Statistical analysis

Data were analyzed by Completely Randomized Design (C.R.D.) The results were statistically analyzed using the analysis of variance table (ANOVA table) and the results were compared using the least significant difference test (L.S.D) at the (0.05) level to test the significance of comparing the results [12].
3. Results and Discussion

3.1 Effect of feeding with vitamins, sugars and pollen on the life of Apis mellifera honey bees in the tenth month

Table 2. showed a difference in the effect of nutrition when taking measurements, according to the type of mixture used (natural pollen + sugar solution + vitamin) compared to the comparison treatment. It gave the highest value in (bee density in nylon packing boxes, open honey in cork boxes, sealed honey in nylon packing boxes and wall packing, pollen in nylon packing boxes, eggs in sandwich boxes, larvae in clay boxes, brood sealed in wall packing boxes, as it reached 536.33, 194, 213, 59.33, 29.33, 75.33 and 111.67 inches$^2$, respectively. While the lowest value was recorded in the comparison treatment for all traits (bee density, open honey, honey, seals, pollen, eggs, larvae and sealed brood, as they reached 303.33, 83.67, 108.33, 29.33, 11 and 34, 62 inches$^2$, respectively. The study agreed with [13], when feeding with sugar solution, vitamins and proteins gave the highest area of brood, larvae and eggs. The effect of feeding was positively reflected in the queen's egg production, an increase in the production of offspring, as well as an increase in field and household occupations, which obviously increases the activity of the colony.

The results of the tenth month gave the highest bee density for all fed cells compared to the control treatment, as it reached 536.33, 525.33, 497.33, 496 and 486.66 inches$^2$. for the cells used (nylon packing boxes, mud boxes, cork boxes, wall packing boxes, sandwich boxes) respectively, while the comparison reached 303.33 inches$^2$ bee density. The difference in the increase in the numerical density of the fed colonies compared to that of the comparison treatment significantly affected the numerical density, which provides a greater opportunity to enter the winter season with strong colonies. At the area of immature honey (open), the nutrient cells gave higher than the comparison treatment, as it reached 194, 181.67, 176.67, 175.67 and 163.67 inches$^2$, for cells (cork boxes, wall packing boxes, sandwich boxes, nylon packing boxes and mud boxes) respectively, while it decreased in comparison, reaching 83.67 inches$^2$.

The results indicate an increase in the open honey in the experimental treatments compared to the comparison treatment, which is almost doubled due to the increase in the bee density of field workers, and this is what achieves an abundance of food in the winter season to overcome the sects stage of food shortage and the damage caused by starvation to the sects, as well as the possibility of the workers continuing to care for the brood and maintaining the appropriate temperatures for the biological behavior inside the pile of workers responsible for heating the brood when the ocean temperature drops to less than 10 degrees Celsius.

The same table, show that the estimation of the area of mature honey (sealed) was superior to the cells treated with nutrition over the comparison treatment, reached 213, 213, 203.67 and 193 inches$^2$ for the treatments (wall packing boxes, nylon packing boxes, mud boxes, sandwich boxes and cork boxes) respectively, while the area of closed honey decreased in the comparison treatment, reaching (108.33) inches$^2$, as for measuring the pollen area, the feeding cells outperformed the comparison (59.33, 58.33, 57.67, 56.67 and 46.33) inches$^2$, for cells (nylon packing boxes, cork boxes, sandwich boxes, wall packing boxes, clay boxes) respectively, while it decreased in the comparison treatment by more than half, reaching (29.33) inches$^2$, as for the area of egg measurement, the feeding cells outperformed the comparison, reaching (33.33, 29.33, 29.33, 29.33 and 27.33) inches$^2$ for cells (wall packing boxes, cork boxes, sandwich boxes, nylon packing boxes and mud boxes) respectively. The comparison is to more than half as it reached (11) inches$^2$. In estimating the area of the larvae, the feeder cells outperformed the control treatment, reaching (75.33, 75, 47, 70 and 58.67) inches$^2$ for cells (mud boxes, nylon packing boxes, cork boxes, wall packing boxes, sandwich boxes) respectively, while the comparison treatment decreased, which amounted to (34) 2 inches, but when estimating the area of the sealed brood, the area of the feeding cells outperformed the comparison, reaching (111.67, 108, 93, 92 and 75) inches$^2$ for cells (wall packing boxes, clay boxes, sandwich boxes, cork boxes and nylon packing boxes) respectively, while the comparison treatment decreased until it reached (62) inches$^2$.

Table (5) also showed that there is a discrepancy in the feeding averages according to the type of treatment during the study period, as the inner packing boxes for the cells with nylon bags gave the highest average feeding, reaching (166.23) inches$^2$ and it did not differ significantly with the treatment of the wall packing boxes and the clay-coated boxes, as it reached (166,048 and 165,048) inches$^2$ respectively. While the lowest value of feeding averages was recorded in the comparison treatment, reaching (90,238) inches$^2$.

The results of the statistical analysis also showed the superiority of the bee density for all traits in the tenth month, as it reached (474.167) inches$^2$ followed by the area of sealed honey, which amounted to (190.056) inches$^2$. Provides nutrition sources of sugars and vitamins as they are important in building a brood.

3.2 The effect of feeding with vitamins, sugars and pollen on the life of Apis mellifera honey bees in the eleventh month

Table 3. showed that there was a discrepancy in the feeding averages according to the type of treatment during the study period, as the inner packing boxes for the cells with nylon bags gave the highest average feeding as it reached (178.857) inches$^2$ and it decreased in each of the cork boxes treatment, the treatment of the clay coated boxes and the treatment of the
packing boxes with walls, reached (146.857, 146.762 and 146.095) inches² respectively, while the lowest value of nutrition averages was recorded in the comparison treatment, reaching (61.905) inches².

The results shown in Table (6) also showed a clear difference in the effect of nutrition when taking measurements, according to the type of mixture used (natural pollen + sugar solution + vitamin) by providing the highest value in the characteristics of (density bee in clay-coated boxes, honey) Opened in nylon packing boxes, honey sealed in nylon packing boxes, pollen in sandwich boxes, eggs in wall packing boxes, larvae in nylon packing boxes, brood sealed in nylon packing boxes, as it reached (33.451, 388.33, 209.33, 54.67, 28, 65.33 and 115.67) inches² respectively. While the lowest value was recorded in the comparison treatment for all traits (density bee, open honey, honey, seals, pollen, eggs, larvae and sealed brood, reached (194, 49.33, 69.33, 38.33, 7.67, 25.67 and 49) inches² respectively. When adding food containing high concentrations of vitamins and proteins, the activity of bees increases as well as egg laying, agreed with [13, 14, 15].

The results of the eleventh month gave the highest bee density for all the fed cells compared to the control treatment, which amounted to 483.33, 451.33, 450.67, 443 and 388.33 inches² in the cells used in (mud boxes, sandwich boxes, cork boxes, wall packing boxes, nylon packing boxes) on the respectively, while the comparison amounted to (194) inches² bee density, as for the area of immature honey (open), the feeding cells gave higher than the comparison treatment, as it reached 388.33, 183.33,136 and 155.33 inches² for cells (nylon packing boxes, cork boxes, wall packing boxes, sandwich boxes, mud boxes), respectively. While it decreased in comparison, reaching (49.33) inches².

As for the estimation of the area of mature (sealed) honey through the same table, the superiority of the cells treated with feeding over the control treatment was shown, as it reached (209, 190, 185.33, 184.67 and173.67) inches² for the treatments (nylon packing boxes, clay boxes, wall packing boxes, sandwich boxes, Cork boxes (inches²) respectively, while the area of closed honey decreased in the comparison treatment, reaching (69.33) inches².

As for measuring the area of pollen, the feeding cells outperformed the comparison, reaching (57, 54.67, 54.67, 51, 39) inches² for cells (nylon packing boxes, sandwich boxes, wall packing boxes, cork boxes, clay boxes), respectively, while it decreased in the comparison treatment, it reached (38.33) inches², while in the area of egg measurement, the feeding cells outperformed the comparison, reaching (28, 26.33, 25, 24, 33, 22) inches² for cells (wall-covering boxes, cork boxes, etc.).

Nylon packing boxes, sandwich boxes, clay boxes) respectively, while it decreased in the control treatment to more than half, reaching (7.67) inches², while in estimating the area of larvae, the feeding cells outperformed the control treatment, reaching (68, 65.33, 61, 51, 50) inches² for cells (nylon packing boxes, clay boxes, wall packing boxes, cork boxes, sandwich boxes), respectively, while The comparison treatment decreased, which amounted to (25.67) inches².

When estimating the area of the sealed brood, the area of the fed cells outperformed the comparison, as it reached (115.67, 95.33, 92, 91, 87) inches² for cells (nylon packing boxes, wall packing boxes, cork boxes, mud boxes, and sandwich boxes), respectively, while The comparison treatment decreased until it reached (49) inches².

### Table 2. The effect of feeding with vitamins, sugars and pollen on the life of Apis mellifera honey bees in the tenth month.

| Treatments | bee density | open honey | sealed honey | pollen | eggs | larval | sealed hug | Means |
|------------|-------------|------------|--------------|--------|------|--------|------------|-------|
| Comparison | 303.33b     | 83.67      | 108.33b      | 29.33b | 11   | 34.67b | 62.1       | 90.238b |
| sandboxes  | 497.33b     | 194.4e     | 193.63e      | 58.331 | 29.33p| 23.74k | 92.1        | 162.571a |
| cork boxes | 486.66b     | 176.67d    | 203.67d      | 57.67l | 29.33p| 58.67k | 93.74b      | 157.952a |
| mud boxes  | 525.33a     | 163.67g    | 209.33a      | 46.33a | 27.33p| 75.33k | 108.04b     | 165.048a |
| wall packing boxes | 496.06j | 181.67f   | 213d    | 56.67m | 33.33o | 70k | 111.67b | 166.048a |
| Nylon packing boxes | 536.33e | 175.67g | 213d | 59.33b | 29.33p | 75k | 75b | 166.238a |

| Means      | 474.167a | 162.556c | 190.056b | 51.278f | 26.611g | 64.500e | 90.278d | 151.349 |

| L.S.D 0.05 | Treatments | Interaction | Reading |
|------------|------------|-------------|---------|
| 9.912      | 26.226     | 10.707      |

### Table 3. The effect of feeding with vitamins, sugars and pollen on the life of Apis mellifera honey bees in the eleventh month.

| Treatments | bee density | open honey | sealed honey | pollen | eggs | larval | sealed hug | Means |
|------------|-------------|------------|--------------|--------|------|--------|------------|-------|
| Comparison | 194.4b     | 49.33a     | 69.33b      | 38.33b | 7.67 | 25.67b | 49b         | 61.905c |
| sandboxes  | 450.67b    | 183.33d   | 173.67e      | 51n   | 26.33r | 51n   | 92j         | 146.857b |
| cork boxes | 451.33b    | 156e      | 184.67d      | 54.67n | 24.33s | 50.67n | 87k         | 144.905b |
| mud boxes  | 483.33c    | 136b      | 190.67d      | 39p   | 23e   | 65.33m | 91j         | 146.762b |
| wall packing boxes | 443b | 155.33g | 185.33d       | 54.67o | 28q   | 61m-n | 95.33j | 146.095b |
| Nylon packing boxes | 388.33c | 388.33c | 209.33d | 57.33o | 25q   | 68k-b | 115.67b-i | 178.857a |

| Means      | 401.78a | 178.056b | 168.833b | 49.167d | 22.222e | 53.611d | 88.333 | 328.2302 |

| L.S.D 0.05 | Treatments | Interaction | Reading |
|------------|------------|-------------|---------|
| 10.004      | 26.468     | 10.806      |
3.3 The effect of feeding with vitamins, sugars and pollen on the life of Apis mellifera honey bees in the twelfth month

Table 4. showed a difference in the effect of nutrition when taking measurements, according to the type of mixture used (natural pollen + sugar solution + vitamin) by providing the highest value in the characteristics of (bee density in cork boxes, open honey in Cork boxes, honey sealed in wall packing boxes, pollen in nylon packing boxes and walls, eggs in sandwich boxes, larvae in cork boxes, brood sealed in cork boxes) it reached (334.67, 126, 140.33, 44.33, 22, 45.67, 84 in) respectively. While the lowest value was recorded in the comparison treatment for all traits of (bee density, open honey, sealed honey, pollen, eggs, larvae and sealed brood) it reached (122.33, 41.67, 42.67, 14, 1.67, 5.67, 14.33) inches² on The study agreed with [13], where feeding with (sugar solution + vitamin + protein) gave the highest area of open brood (12.67) inches².

The results of the twelfth months gave the highest bee density for all cells fed compared to the control treatment, which amounted to (345, 334, 313, 310, 294) inches² used in them (sandwich boxes, cork boxes, mud boxes, wall packing boxes, and nylon packing boxes) on the respectively, while the comparison amounted to (122.33) inches² bee density, while in the immature (open) honey area it gave the fed cells higher than the control treatment as it reached (126, 124.33, 123.33, 110, 107.67) inches² for cells (cork boxes, packaging boxes Nylon, wall cladding boxes, mud boxes, sandwich boxes) respectively, while it decreased in the comparison treatment, reaching (41.67) inches².

Table 4. Effect of feeding with vitamins, sugars and pollen on the life of Apis mellifera honey bees in the twelfth month.

| Treatments                | bee density | open honey | sealed honey | pollen | eggs | larval | sealed hug | Means   |
|---------------------------|-------------|------------|--------------|--------|------|--------|------------|---------|
| Comparison sandwich boxes | 122.33a     | 41.67a     | 42.67a       | 14b     | 1.67b | 5.67p-q | 14.33p-q   | 34.619d |
| cork boxes               | 126d-e      | 107.67a    | 124.33b     | 45.67f-q | 20.33m-o | 45.67k-l | 84d       | 107.286a|
| mud boxes                | 345a        | 107.67b-h  | 120c-f      | 44.33k-l | 22m-o | 43k-l   | 63.67l     | 106.524ab-p |
| wall packing boxes       | 310.67b-k   | 110d-g     | 134.67e     | 34.33l-m | 14.67p-q | 38.67l   | 57.33j-k   | 100.429bc-p |
| Nylon packaging boxes    | 294.33c     | 124.33b-e  | 115.33g     | 41.67d  | 17.67p-o | 37j-m    | 57j-k      | 103.952abc-p |
| Means                     | 286.722a    | 105.500b   | 108.056     | 36.833d | 15.500e | 35.278d | 56.722c    | 92.08730 |
| L.S.D0.05                | 6.607       | Interaction | 17.481      | Reading | 7.136 |

As for estimating the area of mature (sealed) honey through the same table, the superiority of the cells treated with feeding over the control treatment was shown, as it reached (140, 134.67, 120, 115.33 and 95.33) inches² for the treatments (wall packing boxes, clay boxes, sandwich boxes, nylon packing boxes, Cork boxes (inches²)), respectively, while the area of closed honey decreased in the comparison treatment, reaching (42.67) inches². As for measuring the area of pollen grains, the fed cells outperformed the comparison, reaching (45, 44.33, 41.67, 41.67 and 34.33) (inches²) for cells. Cork boxes, sandwich boxes, wall packing boxes, nylon packing boxes, clay boxes (respectively), while it decreased in the comparison treatment by more than half, amounting to (14) inches².

As for the area of egg measurement, the feeding cells outperformed the comparison, reaching (22, 20.33, 17.67, 16.67 and 14.67) inches² for cells (sandwich boxes, cork boxes, wall packing boxes, nylon packing boxes, clay boxes) respectively, while it decreased in The comparison treatment amounted to (1.67) inches².

In estimating the area of larvae, the feeding cells outperformed the control treatment, reaching (45.67, 43, 41.67, 38.67 and 37) inches² for cells (cork boxes, sandwich boxes, nylon packing boxes, clay boxes, wall packing boxes), respectively, while it decreased The comparison treatment, which amounted to (5.67) inches².

When estimating the area of the sealed brood, the area of the feeding cells outperformed the comparison cells, reaching (84, 64, 63.67, 57.33 and 57) inches² for cells (cork boxes, nylon packing boxes, sandwich boxes, mud boxes, wall packing boxes), respectively in When the comparison treatment decreased until it reached (14.33) inches².

Table 7. showed that there was a discrepancy in the feeding averages according to the type of treatment during the study period, where the cork boxes gave the highest average feeding rate, which amounted to (107.286) inches², and it decreased in each of the sandwich boxes treatment, the treatment of wall casing boxes, and the treatment of clay-coated boxes, as it reached (106.524, 103.952 and 100.429) inches² respectively, while the lowest value of nutrition averages was recorded in the comparison treatment, which amounted to (34.619) inches².
3.4 Study the effect of feeding and wintering on cell weight

Table 5. showed that there was a discrepancy in the average weight of cells according to the type of cells during the study period, as the sandwich boxes treatment gave the highest average cell weight, which amounted to (82.51) kg, then came the treatment of the coated boxes, which amounted to (38.81) kg. Then followed by the treatment of wall covering boxes, nylon and cork packing (26.44, 25.21, 22.02) kg, respectively, while the weight of cells decreased in the comparison treatment, which amounted to (14.02) kg.

Table 7. showed that there were differences in the average weight of cells due to the interaction between the type of treatment and the reading period. The sandwich boxes treatment (62.67 kg) gave the highest cell weight during the twelfth month period from conducting the experiment, and the comparison treatment was recorded, which amounted to (11.93) the lowest weight of cells during the experiment.

The results of the statistical analysis showed that the highest weight of cells was recorded after conducting the experiment, which amounted to (43.16) kg, and the lowest weight was recorded for the statistical analysis before conducting the experiment, which amounted to (19.73) kg in the comparison treatment.

3.5 Study the effect of feeding and wintering on honey production

Table 6. showed that the highest amount of honey production amounted to (8.67) kg in the treatment of sandwich boxes with a range (8-9), followed by the treatment of cork boxes, as the amount of honey reached (8.33) kg in a range of (7-10) and the lowest amount of honey production was in the comparison treatment amounted to (1) kg with a range of (0-1) and that the reason for the increase in the amount of honey in the sandwich and cork boxes is that it is made of isolated materials that maintain temperatures inside and outside the cell. The study agreed with [16] through feeding with natural pollen grains, as well as sugars.

3.6 Study the effect of feeding and wintering on the production of parcels

Table 7. showed that the highest number of parcels reached (3.0) parcels with a range of (3) in the treatment of sandwich boxes, followed by the treatment of cork boxes, as the number of parcels reached (2.67) parcels with a range of (2-3), and the lowest percentage of the number of parcels was (0) was expelled in the comparison treatment, and that the reason for the superior number of parcels in the treatment of sandwich boxes and cork was due to the availability of environmental conditions, sources of nutrition and pollen, which provided a suitable environment for breeding in the winter season and...
increased cell activity as it maintained temperature and humidity, which entered the cells at the end of the winter season and the beginning of the spring season. The study agreed with [17] that the treatment of feeding with sugar solution and a group of vitamins was superior to the comparison treatment.

Table 7. Study the effect of feeding and wintering on the number of parcels.

| Treatments       | Range | Standard deviation of mean honey yield |
|------------------|-------|---------------------------------------|
| Comparison       | 0     | 0.0c                                  |
| sandwich boxes   | 2-3   | 2.67a                                 |
| cork boxes       | 3     | 3.0a                                  |
| mud boxes        | 2-3   | 2.33ab                                |
| wall packing boxes | 2-3 | 1.67b                                 |
| Nylon packaging boxes | 2-3 | 1.67b                                 |
| Means            |       | 1.889                                 |

Means 1.889

L.S.D 0.05 Treatments 0.838

Conclusions and Recommendations

- The study achieved its goal in preparing the communities in a healthy state for entering the winter season, as it avoided the bees from the harm of low temperatures and their destruction due to starvation through the use of nutrition with vitamins, sugars and pollen.
- We conclude through the study that the direct addition of pollen grains in the tires provided suitable conditions for the permanence of cells during a season when pollen grains were scarce, so the queen continued her activity to lay eggs and increase the population density.
- The use of new results resulted in the dispersal requirements of the sects under study, which led to an increase in the production of honey and pollen.
- The crossing of sects during the winter season, which contains an increase in the amount of honey and pollen before entering the season of activity, is the biggest evidence of the benefit from the results of the study in the service of beekeepers.

References

[1] Hilal, R.S. 2003. Bee honey in the light of modern science. Dar Al-Maaref for printing and publishing. 227 pages.
[2] Nimr, F.T. and S. Shehadeh. 2002. The role of honey bees in increasing agricultural production, National Center for Agricultural Research and Technology Transfer, National Press, Amman, 56 pages.
[3] Awdeh, H.L. 2013. The Economics of Honey Bee Breeding in Al-Diwaniyah City, Al-Furat Journal of Agricultural Sciences, 5 (3): 316-323.
[4] Somerville, D. 2000. Honey bee nutrition and supplementary feeding. Agnote DAI/178. NSW Agriculture, 1034-6848.
[5] Al-Zubaidi, M.A.S. 2006. Study of some life activities of honey bees (Apis mellifera L.) on flowering plants in the city of Basra, Master's thesis. College of Agriculture, University of Basrah.
[6] Alaux, C., F. Ducloz, D. Crauser and Y. Le Conte. 2010. Diet effects on honeybee immune competence. Biology letters. published online 20 January 2010.
[7] Mustafa, M.M.S.S. 2005. Breeding honey bee queens and their relationship to some pollen substitutes. PhD thesis. College of Agriculture and Forestry, University of Al Mosul.
[8] Shamdin, Z. N. 2003. Effect of supplemental proteins and vitamins on the development of specific tissues with special concern to their fine structures in relation to the activity of honey bee workers Apis mellifera L. (Hymenoptera: Apidae). M.Sc. thesis. College of Agriculture, Dohuk University.
[9] Hader Abdalkhadhm Hamzah; Imad Ali Aubied. "Effect of Pollen Grains and Growth Regulator NAA on Some Fruit Characterization of Date Palm Phoenix dactylifera L Cultivar. Sultani". Al-Qadisiyah Journal For Agriculture Sciences, 9, 1, 2019, 36-42. doi: 10.33794/qjas.2019.162663
[10] Al-Ghamdi, A.A.; N. Adgaba, Y.Tadesse; A. Getachew and A.A. Al-Maktary. 2017. Comparative study on the dynamics and performances of Apis mellifera jemenitica and imported hybrid honeybee colonies in southwestern Saudi Arabia. Saudi Journal of Biological Sciences, 24(5): 1086-1093.
[11] Al-Douri, O.A. and M.S.r Mansour. 2020. Evaluation of the efficacy of some vegetable oils and powders in controlling Varroa destructor (Acari: varroidae) in honey bee colonies Apis mellifera L. (Hymenoptera: Apidae). Master Thesis, Tikrit University, College of Agriculture, 81 pages.
[12] Al-Samarrai, F.R. 2009. Data analysis using the statistical program version SAS 6.12, Veterinary Public Health Branch / College of Veterinary Medicine. Baghdad University.
[13] Taha, S.B. and M.S. Mansour. 2020. Effect of nutrition of proteins, vitamins and sugars in the activity and chemical components of honey bees Apis mellifera L. in the summer. International Scientific Conference. faculty of Agriculture. Tikrit University: 929-942.

[14] Al-Suwaiti, A.M.S. 2017. Studies on the biological activity of Apis mellifera honey bee colonies fed magnetized food. PhD theses. Department of Prevention, Faculty of Agriculture. Tikrit University.

[15] Sahar fadhil saadoun; Hayyaw wewa atia Al-juthery. "Fertilizer Use Efficiency of Nano Fertilizers of Micronutrients Foliar Application on Jerusalem Artichoke". Al-Qadisiyah Journal For Agriculture Sciences, 9, 1, 2019, 16-25. doi: 10.33794/qjas.2019.162661

[16] Nabors, R. 2000. The effects of spring feeding pollen substitute to colonies of Apis mellifera L.. Amer. Bee J. 140(4):322-323.

[17] Mansour, M.S. 2018. Evaluation of the efficiency of natural food products and artificial flavors in the activity of honey bee colonies Apis mellifera L. in Balad district. Journal of Tikrit Agricultural University. (18): 1191-1200.