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## SUMMARY

The nectar and pollen grains are the basic nutrition for honey bees. When these sources are lacked or not available, the beekeeper has to find another nutrition replacement which is sugar solution and Pollen substitutes.

This study demonstrated this by choosing four diets and using them as a pollen substitutes which are not expensive and available in the local market. These pollen substitutes are (Soybean flour - Wheat Germ - Dried Brewer's yeast - Palm Date). Melting these pollen substitutes with the honey as 2:1v/v (except Palm Date is being melted with the sugar as 2:1) and studying their effect on the different honey bee activities shown below:

- 1 - Brood rearing.
- 2 - Pollen gathering.
- 3 - Queen cups building.
- 4 - Pollen substitutes consumption.
- 5 - Hypopharyngeal gland development.
- 6 - Biometrical characters of wax mirror.
- 7 - Longevity.

The study carried out at Mit Ghamr city, Dakahleya Governorate. On Fifteen honey bee colonies, of about equal strength and supplied with mated hybrid new Carniolan queens. These colonies have been divided into five groups, and each group has been divided into three replicates. These colonies have

been treated with the above mentioned pollen substitutes in addition to feeding sugar solution in the hive (1:1w/w) at seven days intervals during the dearth periods of nectar. Except “Control” treated with the sugar solution only. This experiment ran for two successive years 2003-2004 & 2004-2005.

### **1 - Brood rearing:**

- The study results showed that the colonies treated with the Wheat Germ came in the highest level as it gave the highest worker brood area within the two years, then the Dried Brewer’s yeast came in the second rank, then Soybean flour in the third rank, while the Control in the fourth rank, and the Palm Date came in the last rank. As the grand total of sealed brood area in the first year was 6847, 6210, 5291, 4475.33 and 4202 inch<sup>2</sup> for all previous treatments in sequence, while the grand total of sealed brood area in the second year was 7132.67, 5995.67, 5598.67, 4358.33 and 3807.67 inch<sup>2</sup> for all previous treatments in sequence.
- The best brood rearing period was the Spring within the study years as the total of sealed brood area in the first year for the Soybean flour, Wheat Germ, Dried Brewer’s yeast, Palm Date, and Control was 1806.33, 2471, 2099, 1538 and 1590.67 inch<sup>2</sup>, respectively. While the readings of the second year were 1912.33, 2538.33, 2130.33, 1404 and 1667 inch<sup>2</sup> for each of the previous treatments, respectively.
- The lowest brood rearing period was the Autumn within the study years as the total of sealed brood area in the first year for the Soybean flour, Wheat Germ, Dried Brewer’s yeast, Palm Date, and Control was 1051.33, 1197.67, 1192,

872.67 and 911 inch<sup>2</sup>, respectively. While the readings of the second year were 818, 1072.67, 922.67, 636.67 and 634.33 inch<sup>2</sup> for each of the previous treatments, respectively.

- The highest brood production rates during the first year was in June (311.47 inch<sup>2</sup>/colony), and the lowest rates in December (52.13 inch<sup>2</sup>/colony). While the highest brood production rates during the second year was in May (312.29 inch<sup>2</sup>/colony), and the lowest rates in December (54.70 inch<sup>2</sup>/colony).
- The statistical analysis results showed highly significant differences between the Wheat Germ and other treatments, while there are insignificant differences between Palm Date and Control over two years of study.

## **2 - Pollen gathering:**

- The study results showed that the colonies fed with the Wheat Germ came in the highest level as it gave the highest stored pollen area within the two years, then the Dried Brewer's yeast comes in the second rank, then Soybean flour in the third rank, while the Control in the fourth rank, and the Palm Date comes in the last rank. As the grand total of stored pollen area in the first year was 1426.67, 1361.33, 1256, 1060.67 and 993.67 inch<sup>2</sup> for all previous treatments in sequence, while the grand total of stored pollen area in the second year was 1726.7, 1610.63, 1555.7, 1396.33 and 1056.33 inch<sup>2</sup> for all previous treatments in sequence.
- The best pollen gathering period was the summer within the study years as the total of stored pollen area in the first year

for the Soybean flour, Wheat Germ, Dried Brewer's yeast, Palm Date, and Control was 494, 586, 567.67, 390 and 447 inch<sup>2</sup>, respectively. While the readings of the second year were 685.37, 771.03, 716.63 and 494.33 and 638 inch<sup>2</sup> for each of the previous treatments, respectively.

- The lowest pollen gathering period was the winter within the study years as the total of stored pollen area in the first year for the Soybean flour, Wheat Germ, Dried Brewer's yeast, Palm Date, and Control was 127.67, 140.33, 131.67, 93 and 84 inch<sup>2</sup>, respectively. While the readings of the second year were 167, 144.33, 163.33, 58.67 and 96.33 inch<sup>2</sup> for each of the previous treatments, respectively.
- The highest pollen gathering rates during the first year in the period from May (307.56 g/colony) to August (327.38 g/colony), and the lowest rates in the period from December (69.87 g/colony) to February (68.36 g/colony). While the highest pollen gathering rates during the second year in the period from May (320.44 g/colony) to September (383.73 g/colony), and the lowest rates in the period from December (64.40 g/colony) to February (73.33 g/colony).
- The statistical analysis results in the first year showed insignificant differences between the Wheat Germ and Dried Brewer's yeast, while there are highly significant differences between them and all other treatments. Whereas the second year readings showed insignificant differences among Wheat Germ, Dried Brewer's yeast and Soybean flour, while there are highly significant differences between them and all other treatments.

### **3 - Queen cups building:**

- The study results showed that the colonies fed with the Wheat Germ comes in the highest level as it gave the highest number of queen cups within the two years, then the Dried Brewer's yeast comes in the second rank, then Soybean flour in the third rank, then the Control in the fourth rank, while the Palm Date comes in the last rank. As the grand total of queen cups in the first year was 63.67, 57.67, 47.33, 36.67 and 33.67 cup for all previous treatments in sequence, while the grand total of queen cups in the second year was 72.33, 65, 54.67, 41.33 and 28.33 cup for all previous treatments in sequence.
- The best period of queen cups building was the Spring within the study years as the total of queen cups in the first year for the Soybean flour, Wheat Germ, Dried Brewer's yeast, Palm Date, and Control was 23, 36, 30.33, 18.67 and 17 cup, respectively. While the readings of the second year were 26.33, 39.67, 39.33, 16.67 and 19.67 cup for each of the previous treatments, respectively.
- The lowest period of queen cups building was the Autumn within the study years as the total of queen cups in the first year for the Soybean flour, Wheat Germ, Dried Brewer's yeast, Palm Date, and Control was 2.33, 2.67, 2, 1.67 and 1.33 cup, respectively. While the readings of the second year were 1.33, 2, 1, 1 and 0 cup for each of the previous treatments, respectively.
- The highest rates of queen cups building during the first year was in April (5.17 cups/colony) and May (3.13 cups/colony),

and the lowest rates in the period from October (0.33 cup/colony) to January (0.00 cup/colony). While The highest rates of queen cups building during the second year was in April (4.33 cups/colony) and May (4.96 cups/colony), and the lowest rates in the period from October (0.20 cup/colony) to January (0.07 cup/colony).

- The statistical analysis results in the first year showed significant differences between the Wheat Germ and all other treatments. Whereas the second year readings showed insignificant differences between Wheat Germ and Dried Brewer's yeast, while there are significant differences between Wheat Germ and each of Soybean flour, Control and Palm Date.

#### **4 - Pollen substitutes consumption:**

- The study results showed that the colonies fed with the Wheat Germ comes in the highest level as it gave the highest amount of pollen substitutes consumption within the two years, then the Dried Brewer's yeast comes in the second rank, then Soybean flour in the third rank, while the Palm Date gave the lowest amount of pollen substitutes consumption. As the grand total of pollen substitutes consumed by bees in the first year were 4531.83, 4531.57, 3966.7 and 3212.53 g/colony for all previous treatments in sequence, while the total of pollen substitutes consumed by bees in the second year was 5177.2, 5095.8, 4371.43 and 3685.57 g/colony for all previous treatments in sequence.
- The best period of pollen substitutes consumption was the Spring within the study years as the total of pollen substitutes

consumed by bees in the first year for the Soybean flour, Wheat Germ, Dried Brewer's yeast and Palm Date was 1403.77, 1603.43, 1573.9 and 1160.87 g/colony, respectively. While the readings of the second year were 1379.17, 1663.07, 1636.13 and 1321.63 g/colony for each of the previous treatments, respectively.

- The lowest period of pollen substitutes consumption was the Autumn within the study years as the total of pollen substitutes consumed by bees in the first year for the Soybean flour, Wheat Germ, Dried Brewer's yeast and Palm Date was 559.4, 688.77, 752.07 and 450.83 g/colony, respectively. While the readings of the second year were 705.5, 829.57, 828.83 and 520.07 g/colony for each of the previous treatments, respectively.
- The highest consumption rates of pollen substitutes during the first year was in May (220.89 g/colony) and June (232.32 g/colony), and the lowest rates in December (90.38 g/colony) and January (99.23 g/colony). While the highest consumption rates of pollen substitutes during the second year was in May (225.64 g/colony) and June (244.14 g/colony), and the lowest rates in the period from October (101.15 g/colony) to December (110.14 g/colony).
- The statistical analysis results showed insignificant differences between the Wheat Germ and Dried Brewer's yeast, while there are highly significant differences between Wheat Germ and both of Soybean flour and Palm Date within the two years.



## **5- Hypopharyngeal gland development:**

- To perform this experiment, we have put newly emerged bees in cages and treat it with different pollen substitutes, in addition to sugar solution and water. And we took 20 bees from each treatment in each age of the following ages 1,3,6,9,12,15,18 Day(s), and dissected out to determine gland development stages.
- The results showed that the bees fed with Soybean flour gave the highest level in the gland development, while the Control bees gave the lowest one, as the average development degree of hypopharyngeal gland were as follows: 3.02, 2.95, 2.77, 2.13 and 2.10 for Soybean flour, Wheat Germ, Dried Brewer's yeast, Palm Date, and Control, respectively.
- The highest gland development rates in the ages between 6:12 Days after emerging.
- The statistical analysis results indicated that there were insignificant differences between Wheat Germ and Dried Brewer's yeast, while there were highly significant differences between Soybean flour and each of Dried Brewer's yeast, Palm Date and Control. While there were significant differences between the ages.

## **6- Biometrical characters of wax mirror:**

- In this experiment we have took 10 worker bees from each treatment and dissected out in each of the following ages 12, 13, 14, 15, 16, 17 and 18 Day(s). And measuring the longitudinal, transversal and distance between wax mirrors.

- The results indicated that the average of the transversal wax mirror measured was 2.293, 2.286, 2.262, 2.286 and 2.293 ml. for Soybean flour, Wheat Germ, Dried Brewer's yeast, Palm Date and Control, respectively. While the average of the longitudinal measures were 1.314, 1.321, 1.277, 1.314 and 1.297 ml for each of the previously mentioned treatments, respectively. While the average of the distance between wax mirrors were 0.323, 0.304, 0.294, 0.318 and 0.323 ml for each of the previously mentioned treatments, respectively.
- The statistical analysis indicated that there were significant differences between the treatments in the longitudinal measurement and distance between wax mirrors. While there were insignificant differences between the treatments in the transversal measurement. On the other hand there were insignificant differences between the ages.

### **7– Longevity:**

- Fifteen cages were used in this experiment, putting in each 50 worker bees from each colony. Different pollen substitutes were served in addition to sugar solution and water in little jars. Died bees were counted daily, then calculating average life length of worker bees for each cage in the end of the test.
- Results indicated that bees fed with Wheat Germ gave the longest average life. While the bees fed on Soybean flour gave the shortest average life. Whereas the average life length of bees in different treatments were 15.07, 28.94, 23.01, 15.13 and 16.31 Day(s) for (Soybean flour, Wheat

Germ, Dried Brewer's yeast, Palm Date, and Control), respectively.

- It were noticed that there were a highly significant differences between the Wheat Germ and all other treatments. While there were insignificant differences among Control, Palm Date and Soybean flour.

**Conclusion:**

After long time studying, it was very seen that the Wheat Germ is the best pollen substitute at all, as it increase the bee's activities, especially in the lack of pollen grains sources. Folowed by Dried Brewer's yeast, then Soybean flour and the Palm Date come last.