



Journal of Biological Sciences

ISSN 1727-3048

science
alert

ANSI*net*
an open access publisher
<http://ansinet.com>

The Effect of Different Carbohydrate on Laying Queen and Honey Storage in Honeybee Colonies

¹A. Asadi Dizaji, ²H. Moeini Alishah and ³M. Aragi

¹Department of Agriculture, Islamic Azad University Shabestar, Branch, Iran

²Department of Biology, Urmia University, Iran

³Department of Biology, Zanzan University, Iran

Abstract: In order to explain the effects of substituting the artificial nectar for natural nectar, the factorial experiment has been done five times on the four diets and a control group of 25 colonies on the basis of completely randomized design and it has been studied and statically analyzed. The results indicated that there is 1% difference among diets. But there is non significant difference between right direct and the left hand of the honey comb from the number of larva point view. The mean indicated that there is significant difference among high mean and three treatments of honey, starch + honey and sugar. So in the respect of the food expense for each of these treatments, sugar is introduced as the best food for increasing the number of honeybee population and the blend of starch + honey and honey are at the second and third stages. The above mentioned experiments has been studied in the case of the honey production and indicated that there is a significant difference in the level of probability of 5% among food treatments from the rate of honey production point view. With the respect of the means comparison showed that the food treatment with starch + sugar and starch + honey with high mean, significant difference with each other give better effect to the rate of honey production rather than other food.

Key words: Honeybee, carbohydrate, laying, honey

INTRODUCTION

In natural conditions honey bees are in the farms and fields in which use their own foods. There fore, the natural condition has a great role in their life. In times of dearth, substitutes can be fed to the colony. The most common substitutes are white table sugar (sucrose), or High Fructose Corn Syrup (HFCS) which is a converted starch product. HFCS is currently only available in large bulk quantities and not suitable for most beekeepers. There fore the beekeeper must have enough information about the main food resources of the bees. If the beekeeper pays enough attention in winter, it leads to the fact that they will increase a lot which leads to the product of more honey in the coming season. Without any doubt it can be said that the role of even small items is very high which have great comes in the in crease of population of bees as well as economical matters. This fact is true where the use of that item has no other bad results. In fact, when the population of honey bee increases tow main goals will be achieved: coming better the pollination in plants and trees which leads to the efficiency of environment and increasing honey bee products specially honey it. Cost is a primary consideration in agricultural feeds. High costs of table sugar (sucrose) and a good market for honey

prompted beekeepers to test cheaper bee feeds (Barker, 2000). Recently, high fructose syrups produced by enzymatic fermentation of corn starch. have become available at a lower cost than sucrose (Aschengreen, 1975).

In honeybees the highly evolved division of labour includes the performance of many various tasks with age and even involves digestion (Crailsheim, 1992; Hrassnigg and Crailsheim, 1998). Workers are highly effective in digestion the ingested food, nectar and pollen. This is reflected by the production of enzymes like saccharase (Simpson *et al.*, 1968) or amylase in the hypopharyngeal glands, which digest carbohydrates, as well as by the presence of proteolysis enzymes in their midgut, mainly used to degrade pollen proteins (Moritz and Crailsheim, 1987). Amylase and saccharase degrades complex carbohydrates into their monomers, while glucose oxidase helps to preserve the honey by the production of small amounts of hydrogen peroxide. These carbohydrates are also found in honey stored in the combs. According to the above mentioned facts the main goal of this paper is to introduce the best resource of artificial nectar resources among starch plus honey, starch plus sugar, sugar and honey in order to increase the population and recovering the honey bee products.

MATERIALS AND METHODS

The experiment was done in one of the regions in Shabestar (Iran), in the field of one of the beekeepers, during spring of 2004. The hives were chosen according to their population and the age of the queen and other main characteristics. In order to make them the same age, the queen's use of Nokleos hive. From a certain hive, 30 queens were grown and after mating the queens and beginning the laying in the hives mating were introduced to the experimental hives. In this hives the queens of the hives became the same in terms of their numbers. Through this action all the hives in the beginning of the experiment had six combs bee and three combs brood. I had 5 groups of five hives and on the whole there were 25 hives. From this 5 groups one control treatment and the four groups as for experiment treatment. Through this period, the hives were fed by sugar syrups about 50%. In order to adapt the bees to the food, the colonies were fed by food solving in specific time (at 5 pm). In order to determine the standard of population, we needed a scale and a standard comb of Langerstrot was provided and by a silk string which had wax, was divided into 80 rectangular which had 10 cm area. In order to have the brood all the combs which had the brood on them were taken out one by one. The scale was used and all the rectangular were counted and the number of the population of bees for two sides was determined and was recorded. This task was done for all the five hives. After 21 days of feeding by specific food, the estimating and measuring of the population was done. This experiment was done two times so that we can determine the existed changes. Every era of experiment was 21 days so that we had 2 era of 21 days experiment by foods. On the whole, four main formulas were used in this experiment. (1) Honey, whit 50% strength or one to one (one part honey one part water). (2) Sugar, with 50% strength or one to one (one part sugar one part water). (3) Honey + Starch, 25% honey and 25% starch and 50% Water. (4) Sugar + Starch, 25% honey and 25% starch and 50% Water.

RESULTS

The rate of the population: According to variance analyze results of the number of the population; there was a significant difference between different food treatments which had an influence on the population ($p < 1\%$) in both of the experiments. There was non significant difference between the place of putting the brood on combs (left and right comb). Between the food treatment and the place of putting the brood on combs not effect interaction (Table 1).

By comparing the mean of different food treatments and their influence on the number of the population, it was clear that in different steps of treatment 1 (Honey) experiments there was a significant difference between the control group and treatment 4 (Starch + Sugar). But between 3 and 2 treatments (Starch + Honey) and (Sugar) was not any significant difference (Table 2).

The rate of honey production: According to the results, there is a significant difference between different food treatments in both experiments on the honey production ($p < 5\%$) in both of the experiments. By comparing the means of different food treatments in terms of their influence on the honey production, it is show that the treatments of 1 (Starch + Sugar) have a significant difference with control group and other treatments of honey and sugar. But treatments 1 and 2 (Starch + Sugar) and (Starch + Honey) have not significant difference with each other (Table 3). Since determined that there is significant and negative relationship between the production of honey and growing of population numbers (generation) about $r = -0.414^*$. In other words in the time of growing up, the broods and queen laying amount of gathering the honey decreased. Also at the time of honey gathering, queen laying and growing up its population has been decreased.

Table 1: Variance analyze results effect of different carbohydrates on the number of the population (cm²)

Sources	First time	Second time
Treatment feed (A)	2382.658**	2711.430**
Place of putting the brood (B)	30.420 ^{ns}	216.320 ^{ns}
Effect interaction treatment feed and Place of putting the brood (AB)	48.307 ^{ns}	30.070 ^{ns}
E	520.275	337.670

**Significantly different at 1% level, ns: no significant

Table 2: Effect of different carbohydrates on the number of the population (cm²)

Treatments	First time	Second time	Total time
Honey	1061a	608a	8345a
Sugar	934ab	479ab	706ab
Starch + honey	8925ab	430ab	661ab
Starch + sugar	750b	280bc	515b
Control	669b	191c	430b

Means followed by similar letters in each column are not significantly different at 5% level (Duncan's Multiple Range Test)

Table 3: Effect of different carbohydrates on the honey production (kg)

Treatments	First time	Second time	Total time
Sugar + Starch	2.200a	3.006a	2.9a
Honey + Starch	2.100a	3.400ab	2.75ab
Honey	1.300b	2.400b	1.85b
Sugar	1.200b	2.100b	1.65b
Control	1.200b	1.900b	1.55b

Means followed by similar letters in each column are not significantly different at 5% level, (Duncan's Multiple Range Test)

DISCUSSION

There is a direct relationship between the production of honey bee and the rate of its colony. In fact, if the population numbers are high of the bee in the accumulation season of nectar rate of honey and the nectar will be gathered. Because that high consumes honey by brood in the time growing of population number so rate of honey storage is decrease. The results of this study shows that used of honey, sugar and honey + starch in nutrient honey bee's case population increase. But since the price of used food by treatment hives related to sugar is less than the other tow treatments, so the best treatment is sugar and the two other (honey + starch) and honey in steps 2 and 3 are the best treatments in population increasing. White sugar is the most common form of feed supplement. During the course of the year the beekeeper should be prepared to feed bees in fall and spring and in case of emergency. Doull (1974) suspected undigested polysaccharides, particularly starch, to be harmful. The results are in agreement with the researches of Javaheri (1999), Barker and Lehner (1973, 1974). The results of this study shows that used of (Sugar + Starch) and (honey + starch) case storing honey. The cause of storing foods like (Starch+ Sugar) and (honey + starch) is the fact that the foods which contain disaccharide and polysaccharides first must be analyzed by honeybees and then used for larvae. Since honeybees can't to this, they store a lot of it. Feeding honey plus starch did not alter the flight period, although the honey contained some starch-degrading amylase. In drones, feeding additional starch did not alter the flight period or the distance flown, either in normal or dwarf drones (Norbert and Robert, 2005). So small reduce polysaccharides make those storages. The results are in agreement with the researches of Javaheri (1999), Khorvash (1992), Barker and Lehner (1973). We suggest using of (Sugar + Starch) whit beekeepers of that remove all honey in the fall and replace the reserves with sugar syrup.

REFERENCES

- Aschengreen, N.H., 1975. Production of glucose/fructose syrup. *Process Biochemist*, 10: 17.
- Barker, R.J. and Y. Lehner, 1973. Acceptance and substantive values of honey, the sugars of honey and sucrose fed to caged honey bee workers. *Am. Bee J.*, 113: 370-371.
- Barker, R.J. and Y. Lehner, 1974. Acceptance and substantive values of naturally occurring sugars fed to newly emerge adult worker of honeybees (*Apis melleferal* L.). *J. Exp. Zool.*, 187: 237-286.
- Barker, R.J., 2000. Considerations in selecting sugars for feeding to honeybees. <http://www.beesouece.com/pov/usda/abjfeb1977.htm>.
- Crailsheim, K., 1992. The flow of jelly within a honey bee colony. *J. Comp. Physiol. B.*, 162: 681-689.
- Doull, K.M., 1974. Trials with commercial sugar syrups as supplementary or maintenance food for honeybees. *Aust. Bee J.*, 55: 17-19.
- Hrassnigg, N. and K. Crailsheim, 1998. The influence of brood on the pollen consumption of worker bees (*Apis melleferal* L.). *J. Insect. Physiol.*, 44: 393-404.
- Javaheri, S.D., 1999. Nutrition in honey bee. *Agric. Res.*, 2: 12-15.
- Khorvash, M., 1991. The study used of artificial sugar in nutrition honeybee. M.S. Thesis, University of Tehran, Iran.
- Moritz, B. and K. Crailsheim, 1987. Physiology of protein digestion in the midgut of the honeybees (*Apis melleferal* L.). *J. Insect. Physiol.*, 33: 923-931.
- Norbert, H. and B. Robert, 2005. Unlike nectar foragers, honey bee drones (*Apis melleferal* L.) are not able to utilize starch as fuel flight. *Apidologie*, 36: 547-557.
- Simpson, J., I.B.M. Riedel and N. Wilding, 1968. Invertase in the hypopharyngeal glans of the honeybee. *J. Apic. Res.*, 7: 29-36.