# SUMMARY

**Keywords: bees, supplementary feeding, caged honeybees, „expres“ honey**

This research work was structured in two parts: the first part presents data from the literature related to the current state of knowledge, and the second part contains information and results from its own research.

The first part comprises three chapters in which information is presented on:

1. Specificity of bee feeding;
2. Supllementary feeding of bee families;
3. Feed additives used in beekeeping.

The second part of this thesis was structured in four chapters.

Chapter 4 characterizes the material and working methods used during the research, and the other chapters (5, 6, 7) present the results obtained following the three experimental experiments of the study, namely:

• Experiment A: Feeding of some bee families deprived from natural, the objective of which was to determine the influence of some energy syrups on the development of beef minilies in a season;

• Experiment B: Feeding of some caged honeybees, which aimed to determine the influence of different feed sources on quality indicators of bees maintained under isolation conditions;

• Experiment C: obtaining honey varieties and their characterization; the objective of this experiment was to determine the influence of food protein supplementation on honey quality.

Within the research project were used bees Apis mellifera, Carpathian ecotype („carpatina“ bee) belonging to bee population in the Plateau of Moldavia.

As an organization, the biological material used was different from one experiment to another:

- Experiment A: bee minifamilies
- Experiment B: colony-isolated bees
- Experiment C: normal bee families

In the course of the research of this study were determined, on the one hand, bee quality assessment indicators, such as the quantity and number of bees, the amount of food supplies, the number of brood cells, the consumption of food, the longevity of the bees, the bee weight, amount of wax, and on the other hand indicators of appreciation of the quality of honey such as the fat, protein, minerals, polyphenols, saccharose, or density, acidity and electrical conductivity.

The data on bee quality assessment indicators were obtained and managed within the own experimental apiary in Deleni, Vaslui county, and the chemical determinations were performed in the Laboratory of Food Quality Control at the Faculty of Animal Husbandry, USAMV in Iaşi.

**Experiment A - Feeding of bee families deprived from natural picking**

Depriving of bees from natural picking involved the placement of bee boxes in specially spaces (bee lofts) so that their flight was carried out in a controlled volume, determined by the constructive particularities of the respective spaces.

This experiment consisted in the formation of 3 experimental lots (marked A1, A2, A3) of 3 bee minifamilies each, maintained under the abovementioned conditions and comparison based on bee quality assessment indicators with a control lot (denoted A0) consisting of 3 beehives that had normal access to natural picking.

Protein feed was the same for all 9 bees minifamilies in experimental lots and consisted of pollen powder harvested from the flight surface of the experimental apiary. The energy source is the component that differs in the three experimental lots, so feeding was done with:

- lot A1: sugar syrup 2/1 (prepared on the experimental holding);
- lot A2: corn hydrolyzate (DULCOFRUCT);
- lot A3: enzymatic inverted sugar szrup (BONFEED).

Parameters tracked in this experiment were:

- the number of bees
- the quantity of food supplies
- number of brood cells
- food consumption
- the amount of wax built

**Results and their discussion**

Regarding the quantity of food supplies, we noticed that the lowest values of this indicator were recorded in the group fed with sugar syrup, and the highest values in the group that benefited from the natural harvest in all control periods, except for the weeks 2 and 6 when the weather conditions were not favorable for the natural picking of bees in the field. Noteworthy was the last week of control, when there were very large differences between the group that benefited from natural picking and those fed with 2: 1 sugar syrup and corn hydrolyzate.

The number of brood cells is an indicator of bee quality assessment that reflects the colony development status. Regarding this, we noticed that the highest values were recorded in lot A0 (natural picking) and lowest in lot A1 (sugar syrup) throughout the control period. The feed group with enzymatic inverted sugar syrup (A3) is the one that had the closest values to those of the batch with access to the natural picking, with insignificant differences between them during all control periods.

The number of bees recorded values close to the 12 bee families throughout the experiment, with the exception of the last control, when there were larger differences between the field group and the 3 deprived from natural picking.

In relation to the amount of beeswax, the highest values were recorded in the beehives minifamilies that had access to the natural harvest, and the lowest values for the beehives minifamilies that were deprived from natural picking and who received syrup of sugar.

The evolution of all the monitored indicators was favorable to the control group against the experimental groups and this was mainly due to the general behavior of the bees in the experimental groups, who tried to escape from the bee lofts all the time and thus created a state of continuous flight agitation performed in that volume.

Also noteworthy was the more agitated state of the minifamilies of bees fed with sugar syrup prepared in the experimental holding, caused by the smell of this artificial food recipes. Besides, beekeeping practice as well as literature highlights that sugar syrup is very attractive to bees and is the basis for the launch of the pilferage during extra feeding, especially in the autumn.

Generally, all the morpho-productive parameters pursued had higher values in the group that had access to natural picking (A0) and lower values in the lot that was deprived of natural harvesting and was fed with 2:1 sugar syrup (A1). Closer values than those of the control group of these indicators were recorded in the group fed with enzyme inverted sugar syrup (A3).

However, related to the economic efficiency of administering these types of energy to bees in the experimental groups, it was noticed that the lowest cost for wax production and the number of bees at the end of the active season was recorded in the use of sugar syrup prepared in the experimental holding, while the highest cost was recorded in the case of enzyme inverte sugar syrup.

**Experiment B: Feeding caged honeybees**

This experiment used the young bees (0-24 h old), colony isolated, from Apis mellifera, ecotype Carpathian maintained in the three experimental series (30 days in an incubator: the dark 34ºC, 55% humidity), during June 2017-September 2017, each series comprising eight experimental lots of three bee cages each (100 bees/cage).

Each batch was provided with a pre-set feed type and adlibitum water, thus a total of eight recipes, as follows:

• B1-acacia honey (harvested from the experimental apiary);

• B2: sugar syrup 2: 1 (2 parts of sugar mixed with 40 ° C water);

• B3: corn hydrolyzate (from the market);

• B4: enzyme inverted sugar syrup (from the market);

• B5: sugar syrup 2: 1 + pollen (pollen was ground and then mixed with sugar syrup, pollen: syrup = 1: 3 by weight);

• B6: sugar syrup 2: 1+ beer yeast (beer yeast, yeast: syrup = 1: 3);

• B7: sugar syrup 2: 1 + milk powder (skimmed milk powder, milk powder: syrup = 1: 3);

• B8: energy-protein cake (from the profile market, mixed with water, 6 g cake / 3 ml water).

Parameters tracked in this experiment were:

- bee longevity;
- the amount of wax built;
- bee weight;
- food consumption.

**Results and their discussion**

The results obtained from this study show that caged honezbees react differently to bees maintained in the field in terms of the life span and the amount of wax deposited.

After analyzing the results of the energy-fed batches, we noticed that honey has determined bee longevity values lower than the values obtained from feeding with enzyme inverted sugar syrup, which proved to be the best source of energy.

Analyzing the results obtained from batches receiving energy-protein recipes, we noticed that bee processing of proteins has the effect of shortening their longevity. At the same time, we noticed the lifetime of bees that received mixtures of sugar syrup with pollen substitutes (beer yeast, powdered milk) was lower than that of bees that received mix of pollen and sugar syrup. Thus, pollen remains the best source of protein for this thing.

The highest amount of wax was recorded in the group fed with sugar and pollen syrup (608.67 mg), and the lowest in the corn-hydrolysed fed group (267.67 mg). Comparing the results obtained in the group fed with sugar syrup (311.33 mg) and that fed with a mixture of sugar and pollen syrup, we noticed the positive influence of the presence of proteins on this bee production indicator.

Lots fed with sugar syrup blend and pollen substitutes recorded low amount of wax (348.67 mg for beer yeast and 288.33 mg for milk powder), influenced by the general health status of bees that have consumed those recipes.

It has been observed that batches fed only with energy syrups recorded higher values of the average bee weight at the end of the control period over those to whom we added protein to the feed. These results are inconsistent with those obtained in the normal field of care when it is recommended to administer proteins during the autumn period for the deposition of adipose tissue necessary for the cold season.

After analyzing the results of the energy-fed batches, it was noticed that honey (the natural source of bee's energy) determined lower values of the bee's body weight compared to the values obtained from feeding with enzyme inverted sugar syrup, which has proven to be the best source of energy.

Analyzing the results obtained from batches receiving energy-protein recipes, it was noticed that the introduction of proteins into the bee's feeding resulted firstly in the increase in body weight, then the sudden decrease of the body weight, the main cause being the elimination of the intestinal content and the degradation of their general condition .

After day 10 of cage maintenance in the incubator, the weight of the bees began to almost involution, with the exception of periods such as days 16-21, when the values recorded one day were higher than those of the previous day.

Concerning food consumption, it was noticed that the highest values of this parameter were recorded in batches that received only energy feed. This may be due to the increased attractiveness of these sweet syrups and the easier way of harvesting and processing by bees.

Among the energy-protein recipes, the one obtained with the pollen powder mixed with sugar syrup recorded the highest consumption values, while the sugar syrup and yeast blend recorded the lowest values (low attractiveness).

Food consumption did not have a constant evolution or involution because it depended largely on the ingestion capacity of bees from cages, the nutrient requirements for producing wax, and last but not least on the characteristics of the ingredients used in the preparation of the food, which have determined different degrees of filling of the intestinal contents.

**Experiment C: Obtaining special honey varieties and characterizing them**

The biological material in this experiment was represented by beehive families from the experimental apiary, maintained in Langstroth hives.

This experiment involved the formation of three lots of 3 bee families (a total of 9 bee families) that were fed according to the following scheme:

- lot C1: diluted acacia honey 1/1 + 10% powder pollen
- lot C2: diluted acacia honey1 / 1 + 20% powder pollen
- lot C3: dilute acacia honey 1/1 + 30% powder pollen

The following indicators:

- acidity;
- relative density;
- the electrical conductivity of honey;
- percentage of sucrose;
- the water content;
- crude protein;
- crude fat;
- pH value;
- the content of polyphenols;
- the content of minerals (K, Ca, Mg, Na) from honey.

Regarding „express“ honey assortments, their pH did not have a steady course and proportionate to the percentage of pollen introduced into the diet.

The percentage of sucrose had close values and was not influenced by protein supplementation.

Honey obtained from bee processing food with 30% pollen content had lower acidity compared to the other two assortments, while the crude protein content was almost doubled.

From the point of view of polyphenols and of the minerals to be monitored, the supplementation with pollen of bees' feed has led to the increase of the values of these parameters recorded in the obtained honey assortments, as it can be said that the resulting honey can be considered an acacia honey enriched from this point of view.

Regarding the evolution of the quantities of minerals accumulated în honey, there were noticed differences especially for potassium and sodium compared to magnesium and calcium. Thus, although the sodium and potassium contents of honey types were higher than acacia honey, they did not have values proportional to the percentage of pollen. Instead, the calcium and magnesium contents increased with protein supplementation.

From the point of view of raw protein transmission from food in honey, the best ratio was recorded in feeding bees with mixture of dilute honey and 10% pollen, and the smallest ratio was recorded in the mixture of honey diluted and 20% pollen. Even if 30 per cent pollen-based honey feed did not have the best crude protein transfer rate in honey and had the higher cost per kilogram of food, it had the best economic efficiency, determined of the smallest cost for 100 milligrams of raw protein from obtained special honey, while the highest cost was the type of food obtained by mixing the diluted honey with 20% pollen.