ABSTRACT

Beekeeping is one of the oldest human pursuits. He searched a long time to find practical new ways to exploit bees. With the improvement of tools and knowledge innovative methods have opened up, allowing beekeepers to take care of many colonies of bees. Today, the products offered by bees are represented by honey bee, bee pollen, propolis, natural waxes, apilarnil, venom, all with special properties.

Our territory since immemorial times provided favorable conditions for beekeeping. This had a significant value, both for the products and for the contribution of bees in increasing yields through pollination. Essential factors for development of beekeeping in the Romanian territories were favorable climatic conditions and the presence of rich honey resource. Also innovations in beekeeping have completely revolutionized the methods of breeding and exploitation of bee. Of these, we mention the construction of new systematic models of hives, the press for producing artificial combs, the honey extractor, the roller press.

Of the four species of the genus, *Apis mellifera* is the main species exploited in the world. Before the bee`s organized exploatation, its distribution area in Europe, both the latitude and longitude, was limited by winter temperatures, naturally not occurring on the American continent and in the Far East. Regarding altitude, the natural habitat of the species *Apis mellifera* in the Mediterranean region does not exceed 1200 - 1500 meters. Depending on temperatures in winter, colonies can be maintained by apiarists by preparing some favorable winter conditions. Due to the productive value of the species, it has been exported to other continents: America, Asia, Oceania, Australia. Subspecies of honey bee differs by geographic area occupied, and by some behavioral and anatomical characters.

Apis mellifera carpatica, present in Romania, is widespread in the Carpathians, representing a variety of Apis mellifera carnica. Depending on the territories they occupy, several ecotypes have been differentiated by geoclimatical conditions and type of harvest. Bee is gentle, with a weak provision for natural swarming and pilferage. Usually covers the honey dried and has a weak trend for propolisation. It is good enough to withstand winter conditions, has a

low consumption of food and harvest food in short and favorable periods.

Of the hive products, bee pollen, is the only source of proteic food for bees. It is collected from the anthers of flowers and transported to the hive in areas specially adapted on the bees legs.

As a food rich in nutrients, used successfully in prevention of many diseases, bee pollen is collected by devices known as pollen collectors. Chemical components of pollen depends on the plant of origin. Among the substances contained in pollen, proteins are between 7 and 35%, between 3 and 45% carbohydrates (especially from the addition of nectar) and between 4 and 13% lipids. From the water-soluble vitamins were detected thiamine (B1), riboflavin (B2), pantothenic acid (B5), pyridoxine (B6), PP vitamin, folic acid, ascorbic acid (C). Among the fat-soluble vitamins, tecoferol (E), retinol (A), the D complex vitamin. Total minerals varies between 2 and 3%. Other compounds are identified from the pigments class (routine), enzymes (amylase, invertase, protease, lipase, phosphatase, catalase and lactase), organic acids (citric, tartaric, malic, malonic, succinic, aconitic, giberelic, adipic, acetic indolil, alpha cetoglutamic and fumaric) and various phenolic compounds. Biological properties of pollen, represented by its beneficial effects are directly related to its biochemical characteristics. Today, polyphenols are of particular importance, owing to its antioxidant value. Our study provides data on the dynamics of these compounds depending on storage conditions. Existing studies on the dynamics of the chemical properties of bee pollen are scarce.

Quality of bee pollen is given by its degree of freshness, processing, packaging and storage conditions that it has undergone. Pollen is important in determining the geographical origin of honey by microscopic and palynologycal analysis of the residual particles in honey mass. Identification of pollen in honey is based on its comparison with data from literature, on pollen grain morphology and phytocenologic surveys collected from specific area. Romanian literature on the morphology of its indigenous speciesis is relatively poor, most data are taken from foreign literature, thus not showing geographical specificity. However, most of these descriptions were made on botanized and chemically treated specimens. Prior studies noticed differences in the size of pollen morphological indices, between treated pollen and pollen in native form. At present the data on pollen of Romania are general, isolated or missing.

The amount of pollen collected depends on: external factors represented by geo-climatic conditions, vegetation period; internal factors of the hive, represented by the interrelations established among the existing quantities of food in the hive, brood, free cells, the health of bees, queen prolificacy; factors that relate to the organization of bee hive by the beekeeper, the type of collector used, the default type of active plate.

Materials and working methods proposed are diverse and well adapted in accordance

with the requirements and rigors of each experimental series.

Research compiled sought to complement and clarify some issues relating to the pollen morphology of plant species of interest in beekeeping; effectiveness of pollen collection by collectors according to its type, active plate model used, the use of the preparatory period and the interrelations established among various internal factors of the hive. It also followed the dynamics of pollen and chemical properties of its extracts depending on time, temperature and light.

Biological material used consisted of fresh pollen from the plant species pursued and harvested during the flowering period of each; bee pollen obtained by using pollen collectors, in different locations of beekeeping in Moldavia.

Experimental series I included pollen analysis of 78 species of plants visited by bees for pollen. It has been pursued pollen description and measurement of micrometric index (length, width, height, different species-specific configurations), depending on the species examined. There have been made about 4000 photographs under microscope, on which were performed precision measurements. The statistical data obtained have geographic specificity for Iaşi area, being useful in all subdomains of applied palinology. The average length for pollen grains analyzed, respectively for izodiametric pollen diameters was 40.025 ± 1.729 μ. The pollen of the 78 analyzed species had a minimum diameter of 20.713 μ and a maximum of 114.37 μ.

Experimental series II, sought the efficiency of some pollen collectors and its influence factors. Depending on the amount of pollen collected from a total of 16 bee colonies with the same power, the effectiveness of pollen collection has been compared, using two types of collectors: for the bee entrance and for the base of the hive. The differences in values obtained suggested a high-efficiency of collectors for bee entrance. Statistical averages also showed a better effect of collectors, if used without a preparatory period. Between quantityes of pollen, quite large differences were obtained, so that the internal situation of the families concerned was also recorded. There have been photos of all frames from the hives. They were then examined and assessed the quantities of honey, unsealed brood,covered brood, pollen storaged, free cells. The situations obtained, also revealed some aspects of the interrelations existing in the hive and their influence on pollen collection.

Research on the effectiveness of pollen collection by using different types of active plates have measured the impact of the three models used on the intake of pollen. SWe used three experimental lots of 3 hives, in which both power and amount of brood was close. Pollen collections were made at 2, 4 and 6 days, resulting in a dynamic of the quantity of obtained pollen. The values obtained revealed a growing pollen collection tendency for all groups. After six days the average values were 66.678 g for the simple active plates with circular holes (L1);

48.145 g for the active plates with circular holes and landing pad (L2) and 42.695 g for the active plates with star shape holes (L3), with a significant differences between groups L1 and L3. Research on the effectiveness of pollen collection by bees, according to the nectar-honey intake and the quantity of brood from the hive have highlighted the interconnectivity of some hive internal factors and their influence on pollen collectionThe experiment used four groups with the same power of 3 families of bees, each group being chosen so as to alternate weak/good quantities of brood and honey. Data were analyzed using descriptive statistics and analytical ANOVA (with Tukey and Fischer tests) and a multiple correlation test to determine any correlations that may arise between the internal factors of the hive, and to determine the meaning of each variation. The correlation between the amount of stored honey and brood proved to be negative for all groups analyzed: growth stocks of the honey bee colony is in a direct relationship with the decreased number of brood cells. Also, observed correlations between the amount of stored honey and pollen collected was negative, indicating that although the activities of gathering nectar and pollen are equally manifested, are controlled differently or they are in an indirect relationship. Thus, with increasing amount of stored honey, pollen collected tend to drop. The data obtained show that when the intake of pollen is increasing, nectar flow trend will be declining.

Experimental series III, included chemical analysis of multiflower bee pollen. We determined some chemical constituents of pollen. For fresh pollen were obtained average value of 9.19% absolute humidity; of dry matter of 90.73%; 2.83% of total mineral; organic matter 87.98%, 5.9% fat, 24.56% protein and 2.08 mg/100g easily hydrolyzable nitrogen (ammonia). The values dynamic has fluctuated both for the compounds analyzed after 3 and after 6 months for all storage conditions.

Research has included the analysis of the dynamics of polyphenolic compounds, with an important antioxidant role. We determined the amounts of total polyphenols, flavanols, total flavonoids and anti radical activity of pollen and its extracts. These tests were performed on fresh pollen and repeated after one week that after two weeks, aach sample was kept in different conditions of temperature and light. Two methods were used, consisting of different concentrations of methanolic solvent used (96% and 70%). Using a higher concentration of solvent, the average quantities of fresh pollen obtained from the compounds were as follows: 27.64 mg GAME / g pollen (gallic acid equivalent) total polyphenols, 8.57 mg QE / g pollen (quercetin equivalents) flavones; 20.44 mg QE / g pollen total flavonoids. Anti radical activity produced by the method of neutralizing free radicals (DPPH) was 24.48% inhibition. The dynamics of values fluctuated depending on both storage conditions and method used.

Higher amount of total polyphenols, detected after the second week, shows that they are

released gradually. Thus, the biological action of compounds can be highlighted better, if the pollen is preserved at least two weeks. Increasing values can be explained by the disintegration of the pollen coating and the increasing amounts of polyphenols released.

The quantities of flavanols have been higher after the second week, also highlighting the gradual release of these compounds. Thus, the biological properties of specific assets can be better identified after the second week.

The values obtained showed a maximum antioxidant activity of fresh extract when the solvent concentration is higher (96%), anti radical activity recorded value being higher after two weeks of storage when the extract solvent was less concentrated (70%).

Flavonoids present in the pollen analysis are partly responsible for its antioxidant properties. However the anti radical capacity detected in detection systems (in vitro), do not exhibit the same biological properties in living organisms (in vivo).

In determining the antioxidant activity, an essential role has the methanolic solvent concentration used, by its action on the pollen wall, releasing with a greater or lesser efficacy the active ingredients contained in the pollen. From the analysis of anti radical dynamics, we showed, that it is more pronounced after the second week, antioxidant effects of pollen can be better detected by at least two weeks of storage.