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ONE HEALTH CONCEPT, CONSEQUENCE OF BIO-ECONOMIC AND ECO-ECONOMIC MANAGEMENT APPLICATION IN APICULTURE

Cristinel Gigi ŞONEA[1], Andra Cristina ŞONEA[2], Florin Leontin CRISTE[3], Octavian POPESCU[4], Claudia Terezia SOCOL[3]

[1]Valahia University of Târgovişte, 2 Carol I Blvd, Târgovişte, Romania
[2]Institute for Diagnosis and Animal Health, 63 Dr. Staicovici Street, Bucharest, Romania
[3]National Agency for Animal Husbandry "Prof. dr. G. K. Constantinescu", km 18,2 Bucharest-Ploieşti Road, Baloteşti, Romania
[4]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, Bucharest, Romania

Corresponding authors emails: cristinel.sonea@yahoo.com; clausocol@yahoo.com.

Abstract

One health concept aims to achieve and develop a competent bio-economic and eco-economic beekeeping management, based on scientific principles. It is an activity of national interest, useful for preserving a natural and healthy environment, ecological system and agriculture, in general, intended to ensure natural pollination of honey plants and bee species biological diversity, and in particular for the national genetic background in Romanian bee breed - Apis mellifera carpatica - as autochthonous bee population specific for the Romanian bio-apiculture areas. Concerning the importance of bees in human and humankind, Albert Einstein quoted "If the bee disappeared off the surface of the globe, then man would have only four years of life left". The famous physician referred to bees role as crop pollinators and also in achieving significant agricultural yields, that would not be possible in absence of pollinators, and their lack would have devastating impact on food procurement. The present paper overview one health points for a sustainable management in apiculture.

Key words*: apiculture, bio-economic, eco-economic, management, one health.*

INTRODUCTION

Bio-economic and eco-economic bee management context

Paleontological research confirms that bees appeared on earth long before humans. As was the case everywhere, the first primitive tribes representing the first forms of organization of human society, clustered near the watercourses and forests, where they could procure food by hunting and fishing. By searching food, they discovered in the hollows of trees the sweetness and aroma of honey combs which, at first, they reaped great risks from stings, using water for defence. After the discovery of fire, smoke proved to be a better protector against the aggressiveness of bees. That is how hunting of bee nests began, which lasted for millennia and being still a practice today in some areas of Africa and Asia (FAO).

The honey bee belongs to one of the most advanced groups of *Hymenoptera* insects-order (have two pairs of membrane wings), *Apidae* family, *Apis* genus, *mellifera* or *mellifica* species (ADW). This order shows the social life and organization of individuals into the colony or family, equating as functionality with a macro-organism, which entails division of labour, joint care of the offspring, joint food collection and processing, concentrating the reproductive potential of the organism to a single *queen* and to a few male-*drones*, joint regulation of the social organism warmth. As a consequence of this social life, emerged large population of individuals with maintain functions - *workers*, for accumulation of food supplies, showing remarkable adaptations and morphology adaptation related the digestive, respiratory, muscular, nervous, reproductive, excretory, exceptional performance of the sense organs, on enzymatic and hormonal systems, all resulting in spectacular aspects of behaviour. Given these adaptations and refinements, the colony of the honey bee is considered in zoology as a "superorganism" in which the nutrition, breathing, defence and reproduction functions of have both individual and social level (Hung et al., 2018).

An important role in maintaining an ecological balance in beekeeping and the concept of "*one health*" is the pollination of plants and their biodiversity with the help of bees, having an essential contribution in agriculture (Dietrich et al., 2016), helping to the increase of agricultural yields by up to 35%. Recent studies performed by Food and Agriculture Organization of United Nations (F.A.O.) shows that increasing the density and variety of pollinating insects has a direct impact on crop productivity by helping the development of small farmers to increase their globally production by up to 24%. With a view of development of a bio-economic and eco-economic management at the European Union level (Forstner and Rusu, 2015; Rusu et al., 2020), is important also the number of beekeepers of about 620,000, who practice beekeeping both as a hobby and as a professional activity, and therefore signify-cantly contributing to the society development and economically with about 14.2 billion euros/year to the budget. Throughought a bio-economic and eco-economic approach, the increase in beekeeping economic efficiency is shown by the optimal sizing and exploitation of hives. Also, the honey potential and environmental conditions in Romania can ensure a livestock of more than 2,100,000 bee families by 2025, and with an annual honey production of more than 40,000 tons. Currently, statistical data show a livestock of only 1,650,000 bee families with a production of 25,000 tons of honey. So, from previous information we can easily conclude how great are our country's possibilities in terms of beekeeping development (Popescu, 2017).

The main conditions concurring to achieve a high-performance production in beekeeping:

- holding of optimally sized hives (minimum 50 bee families) equipped with all the inventtory required to achieve a diversified production;
- strong bee families in active state with a maximum number of pickers at the date of honey plants flowering;
- at least 500 m² honey base abundance for producing of nectar and pollen, within an area of maximum 2 km distance from the permanent hearth of the hive;
- hardworking and good organizer beekeeper, and connoisseur of bee breeding technologies and beekeeping production;
- favourable weather conditions for the collection of nectar and pollen by bees.

MATERIALS AND METHODS

The paper is an assessment of the bio-economic and eco-economic status in the apiculture sector in Romania, carried out to point the advances achieved and some relevant aspects to consider
for beekeeping development and management, according to the actual European regulations. M.A.D.R. data were used to perform the present analysis. Also, a forecast for bee sector for our country was made.

RESULTS AND DISCUSSIONS

Strategies and challenges for bio-economic and eco-economic bee management in Romania

Strategy for bio-economic and eco-economic management development of the of Romania's beekeeping in the last 15 years:

Currently, due to the liberalisation of all activities, recognition and consideration for private property in the beekeeping sector too, **essential mutations in the practice of beekeeping and sizing of hives have been produced**, tending to the transition from subsistence to professionalization. Amateur beekeepers with small hives have largely given up this activity, and semi-professional and professional beekeepers have the opportunity to modernize and increase their farms to 50-300 bee families and even more, at some farms level with more than 2,000 hives.

Table 1. Dynamics of Romanian beekeeping in the last 15 years

Year	**U.M.**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2015**	**2018**
Bee families	Thousends	990	1,065	1,150	1,015	1,190	1,250	1,394	1,849
Honey production	tons	12,124	14,579	15,279	14,410	15,678	16,125	27,893	30,875
Average production /hive	kg	12.25	13.69	13.29	16.17	14.02	14.50	20.0	19.25

In terms of beekeeping holdings forms of ownership and structure, the following changes have been made in the last 15 years:

- during 1989 the private sector owned 84.3% of total livestock, and in 2018 was reached 99%;
- regarding the average size of the beekeeping holdings and the production of honey per bee family, in the private sector (majority) the comparative situation is presented according to the data in Table 2.

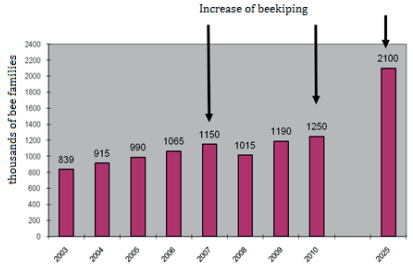

Figure 1. Dynamics of the number of bee families during 2003-2010 and the forecast for 2025

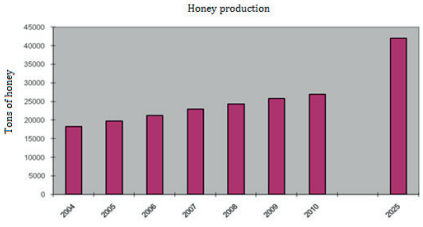

Figure 2. Honey production in the period 2004-2010 and forecast for 2025

Table 2. Comparison between beekeeping farms and honey production on the bee family, in the private sector

Analysed elements	Reference years		Percentage evolution
	1989	2018	
Number of holdings (beekeepers)	98,774	23,161	42.65
Number of bee families	1,196,400	1,848,790	64.7
Number of families per farm	12	79.8	665.0
Honey production kg/bee family	8.5	19.25	226.5

**estimative data, without census*

From the presented data it can be seen a drastic decrease in the number of subsistence farms 3-10 bee families, where honey production is very low, achieved with a high cost price which exceeds selling price, and being intended for self-consumption. There is a substantial increase (90.8%) of the herd on the holding from 10 tons more than 25 bee families, which has led to an increase in the percent of family farm holdings, where the production is achieved at acceptable cost price, intended for direct marketing to consumers and for self-consumption. These types of farms are of interest to their owners, as they contribute to the completion of the family income from the basic activities.

The next step towards the activity of professional beekeepers is the commercial holdings consisting of a herd of at least 50 bee families, equipped with high-performance machinery and installations, in which advanced technologies of growth and exploitation can be applied. **This will increase production and profit per unit of production (bee family). The current data shows honey production per bee family in the reference years (1989 and 2020), main indicator which an increase exceeding 226.8%.**

Currently only 25-30% are included in this commercial holdings category**, and in the next 5-10 years we expect the share of bee families in this category to increase up to (60-70%)**

The eco-economic importance of beekeeping

The role of bees is special and can be easily highlighted, not only by the value of the direct products that man harvests from bee families, but also by the value of the increase of agricultural products that are obtained from cultivated and spontaneous plants, through pollination. Production increases and qualitative increases by pollination by bees shall be assessed to exceed at least 20 times the value of direct bee products obtained from bee families. Every year, honey and other bee products are obtained from each bee family in value equivalent of over 50 kg honey (Champetier et al. 2012).

Bee products have a significant economic value, but also food importance, vitalizing and medicinal energy for humans.

The ecological importance of beekeeping

It shows a crucial role in the sustainable development of rural areas, jobs and provides an important ecosystem service through pollination by improving biodiversity throughout preserving the genetic biodiversity

of plants (Bran et al., 2014). Beekeeping and biodiversity are interdependent. Through pollination, bee colonies provide us with important ecological, economic and social public goods, thus ensuring security, feeding and maintaining biodiversity (Kratschmer et al., 2019).

Figure 3. Bee products

Honey bee. It is obtained from the nectar of flowers or from sweet secretions on plants, being known as an extraordinary source of energy, but also as an excellent product for health due to its content in minerals, enzymes, amino acids, vitamins, and also**:**

•it is found throughout the history of humanity, contributing to the well-being of man for whom it represented and represents a healthy food, but also known for its numerous therapeutic applications.

• depending on the plant sources visited by bees, honey can be mono-flower, poly-flower or manna honey.

The great honey lovers compare, with all conviction, the diversity of honey assortments with that of cheeses and wines, each assortment of honey being unique, its aroma being closely related to the species of flowers "visited" by bees and always varies according to region, altitude and location of the hive. **Sugars, water and plant substances** - that's all honey is composed of, it seems a very simple formula and yet, man is not able to manufacture it - the only thing he can do is take it from bees. Even in the last century, the beekeeper interfered very little in this process, but now, like any modern breeder, seeks to increase the yield and/or quality. But today, as yesterday, honey remains the exclusive product of bee labour**.**

Pollen. It represents the male reproductive element of flowers, which bees collect and mix with their salivary secretions and nectar, they store it in the hive as protein food - in the form of pasture, without which the life of the colony would be impossible. Contains numerous essential elements for life: amino acids, proteins, enzymes, mineral elements and trace elements, B-group vitamins, significant amounts of beta-carotene, vitamins C, D and E, antibiotic-acting substances, hormone-type substances and growth factors. It is consumed as a nutritional supplement in order to strengthen the body and increase its natural resistance to infections. In medicine it has wide applications especially in liver diseases, prostate diseases, psychiatric disorders (Brosi et al., 2017). It is an excellent natural factor in preventing degenerative phenomena **associated with the aging process**.

Propolis. It is a mixture of natural resinous substances, plant and bee waxes, collected from the buds, bark and branches of trees or shrubs, for the purpose of thermal isolation of the nest, polishing the beech cells before the laying of the mats and cleaning the nest. The natural composition of propolis: flavonoids, phenolic compounds, aromatic aldehydes, cumarines, vitamins and mineral elements give the product excellent properties designed to ensure the maintenance of the proper functioning of the body. It has a number of properties: antioxidant, anti-inflammatory, antimicrobial, scarring, local anesthetic, internal remedy (diabetes, cancer, rheumatism, cardiovascular, bronchopulmonary and liver diseases), external remedy (dermatological diseases, burns, wounds, etc.). Its lack of harmfulness has attracted the interest of nutrition and therapeutic specialists, being considered one of the most interesting and promising natural resources of the future.

Royal jelly. It represents glandular secretion of young bees intended to feed the dandruff and for the first phase of brood growth. It is a viscous-looking product of creamy white colour, contains essential elements like: amino acids, proteins, lipids (superior unsaturated fatty acids, phospholipids) and can be considered a true cocktail of vitamins (especially B complex), minerals, substances with antibiotic action, hormonal precursors and

growth factors. It is recommended against fatigue, improvement of physical strength, restoration of physical and mental balance, prevention and treatment of numerous diseases.

Bee venom. It is secreted by specialized glands of worker bees and dandruff and it is used to defend the hive against intruders, and the silks use it to kill and eliminate rivals. Contains a wide variety of substances: biogenic amines, peptides, enzymes, which despite the unpleasant connotation associated with the name "venom" are very important for human body. The effects are known from ancient times, which is why the product has been used in traditional medicine. Recent methods of treatment consist of the application of injections, the application of bee venom therapy in acupuncture centres. To avoid pain associated with conventional bee sting treatment or injections, this is the active component of ointments with local apiphytotherapeutic application. The main conditions in which it proves its effectiveness are rheumatism, neuralgia, multiple sclerosis, but also as a stimulant of the immune system (Marghitas et al. 2010).

Bee wax. It represents a homogeneous and complex blend of organic chemicals that offer well-defined characteristics and which overall determine the extraordinary properties, making it an invaluable, uninhabitable product in a number of areas. Since ancient times it has been used for a wide variety of products: poultices, cheekbones, beauty creams, in the pharmaceutical industry is used in ointments, filming tablets or as glue.

Our country has a long tradition in the field of bee breeding and beekeeping products, beekeeping being a stand-alone occupation according to the historical testimonies existing in this regard (Madas et al., 2020).

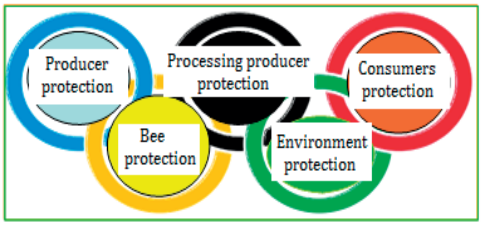

Figure 4. Integrated protection in beekeeping

Environmental protection

Identification and prevention of environmental pollution due to highly developed sense organs bees distinguish as many types of odour as humans perceive. The products resulting from the activity of bees contain the emissions present in the environment within an area of about 3 km around the hive.

The sensitivity of bees is particularly high compared to the main chemical pollutants, industrial and biological noxious substances, radioactive substances, various dusts loaded with heavy metals, toxic gases, noise pollution. Worldwide, specialized FAO organisms have placed bees in fourth place in a classification of environmental pollution sensors.

In order to maintain ecological balance and a healthy living environment, it is necessary to protect the bees. In countries with advanced economies and concerns in environmental quality testing, bees have started to be used in recent years for detection of polluted areas (Matias et al., 2017).

Protection of producers and processors in beekeeping.

Consists in the need to identify and register beehives uniformly at national level, with annual revisions and updates (M.O. no. 119/2011); promoting the establishment of national supervisory systems in close cooperation with beekeepers' associations and the development of harmonised standards at EU level to allow for comparisons; during treatments for prevention and control of diseases and pests in honey plantations, agricultural producers must notify all beekeeper owners about these actions; supporting scientific research on official control of beekeeping production with a view to the creation of elite farms; strengthening relations with beekeepers and beekeeper organisations, compensation granted to beekeepers for losses of bee populations (Bortolotti et al., 2014).

Consumers protection in beekeeping

- establishing clear legal definitions for all bee products, including honey varieties;
- definition of the important parameters for honey quality: proline and sucrose content,

low humidity level, pollen spectrum, honey flavour and sugar content;
- research development in order to find effective methods for detecting honey falsification;
- implementation of EU origin indication systems on labels (PDOs and PGIs) for bee products, by beekeepers and representative organisations;
- measures aimed to increase the consumption of honey and bee products originating in Romania, including by promoting certain types of honey with characteristic properties of certain varieties or geographical areas.

CONCLUSIONS

Beekeeping is the activity that gives practitioners numerous satisfactions. Beekeeping lovers, i.e. beekeepers, are people of all ages and professions, but who have one common point: the love of bees. Beekeeping has both a material side: honey, pollen, pasture, wax, propolis, as well as a spiritual one. There's nothing like the hum of a swarm of bees or a walk through the hive: hives that pulsate with life, bees that come back with full bags of pollen and honey, queens that perpetuate life, drones in constant search of love. What could be more uplifting? What other skill can create so much self-satisfaction? The answer is simple: hives, beekeepers, bees, nature - they are parts of the same whole and that is called beekeeping.

The present approach for defining the conditions for one health concept implement-tation in apiculture in our country is showing bio-economic and eco-economic aspects for an efficient management, adapted to the actual status of bee sector, pointing out new challenges in this area.

The new perspectives compiled in this paper point out both the present requirements and directions for beekeeping, which we recommend to be applied and considered in the apiculture sector.

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TECHNOLOGIES OF THE AGRO FOOD PRODUCTS PROCESSING