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THE CURRENT STATE AND MAIN DIRECTIONS OF DEVELOPMENT OF THE BEEKEEPING INDUSTRY

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Abstract. *The article examines the current state and prospects for the development of the beekeeping industry in Ukraine. Ukraine is known as one of the most powerful beekeeping countries in the world due to its favorable geographical location and ability to produce high-quality beekeeping products for both domestic consumption and export. In the article is emphasized the special role of beekeeping in the agro-industrial complex of Ukraine. The beekeeping industry not only produces useful food products, but also forms the raw material base for the processing industry, contributes to increased productivity and is of great importance for the product market. To achieve the goal, general scientific methods of research, such as empirical, theoretical and calculation-mathematical, were used. There was conducted a review of scientific sources, articles and publications related to the field of beekeeping, honey production and the number of bee families. This analysis provided an overview of the honey market and identified key aspects for further research.*

Statistical data on honey production in households, enterprises and farms, as well as data on the number of bee colonies were used to assess the state and dynamics of the development of the beekeeping industry. In addition, computational and mathematical methods were used for a comprehensive analysis of the sector's problems and prospects.

The general conclusion of the article is that the beekeeping industry in Ukraine is under the influence of various factors, such as the decrease in the number of bees, climate change and external threats. The question of the mechanism of the formation and functioning of the honey market, the question of the development of market

relations between producers, processors and suppliers of beekeeping products, and the economic efficiency of the production of beekeeping products require further research. The prospects for the development of the beekeeping industry lie in organic beekeeping and the use of modern technologies.

Key words: *production, honey, beekeeping, competitiveness, productivity.*

Introduction.

Analysis of recent researches and publications. Ukraine is one of the five leading countries in the world with developed beekeeping. This industry plays an important role in the country's economy and ensures the production of honey, wax, pollen, propolis, royal jelly, bee venom, and pollination of entomophilous crops. In addition, large areas of honey-bearing lands, favorable climatic conditions, thousands of years of experience in keeping bees, highly productive breeding potential of bees testify to the possibility of further development and effective functioning of the industry. The special role of agrarian production of beekeeping products is due to: (1) the production of food products to meet the needs of the population, (2) the production of raw materials for industry, and (3) the provision of foreign currency income from the sale of beekeeping products on the world market, provided that this export-oriented industry is highly competitive. The world market of beekeeping products is developing intensively, the demand for beekeeping products is growing every year. Therefore, the production of high-quality beekeeping products, as a component of the state strategy of a competitive agricultural sector, should be formed at a qualitatively new level, taking into account the achievements of scientific and technical progress.

In these circumstances this article is important and actual due to changes and challenges that appear as on domestic and foreign markets.

Analysis of recent researches and publications.

Studying the conditions of operation and development of the beekeeping industry is an urgent problem, which is given attention in the scientific works of such authors as Vakulenko L., Yemets K., Levandovska A., Khristenko O., Chekhov S., and Yatsenko O. They contribute to the research of this field by examining various aspects of its functioning and development paths.

In their works they have focused on problems related to the justification of effective models of development of beekeeping enterprises. They examine various aspects of beekeeping management, including the organizational structure of enterprises, the production process, marketing strategies and product quality management. They develop models that help beekeeping enterprises to achieve efficiency and competitiveness in the market.

Purpose. The purpose of the article is to study changes in honey production and to analyze the current state and prospects for the development of the beekeeping industry in Ukraine. The study is aimed at analyzing the dynamics of honey production in Ukraine and identifying the main factors affecting the production potential of this industry.

In order to achieve the goals of the research, data will be collected and ana-

lyzed on the volume of honey production in Ukraine for different years, as well as changes in the number of bee colonies during the studied period.

The results of the research will make it possible to understand the trends of honey production in Ukraine and to assess the potential for increasing the productivity of bee colonies. Based on the received data, recommendations and strategies can be formulated for increasing honey production, as well as determining the main directions of development of the beekeeping industry in Ukraine.

Materials and methods of research.

During the research, there is were used different scientific methods to achieve the goal. An analysis of scientific sources, articles and publications related to the honey sector was carried out to assess its current state. This analysis facilitates us understand the main aspects of the topic and identify directions for further research.

There were also used statistical data to assess the state and dynamics of the beekeeping industry. These data included: honey production in households, enterprises and farms; data on the number of bee colonies in Ukraine, as well as other statistical indicators. This allowed us to obtain quantitative data for analysis.

The use of various scientific methods gave us the opportunity to conduct a comprehensive study and answer on questions that were stated.

Results of the research and their discussion.

Scientific research and innovations in the field of beekeeping are aimed at improving the conditions of keeping bees, increasing productivity and ensuring the sustainability of this industry. The main areas of development of beekeeping include protection of bees, improvement of genetics, increase of productivity and use of modern technologies.

One of the significant aspects of the development of beekeeping is the preservation and protection of bees from harmful influences such as pesticides, diseases and parasites. Research in the field of ecotoxicology and environmental safety establishes a relationship between the use of chemical plant protection agents and the health of bees [19]. In particular, in efforts to reduce the negative impact of pesticides on bees, the effectiveness of biological methods of pest control and the use of biologically active substances is being investigated [2].

Another important area of development is the improvement of bee genetics. The use of modern methods of molecular genetics and genomics makes it possible to isolate genes responsible for resistance to diseases and other useful properties [14]. The use of methods of artificial crossing and selection helps to select the best families of bees with high productivity, good health and excellent honey quality [18].

To increase the productivity of beekeeping, it is important to use effective methods of keeping bees and collecting honey. Scientific research in this field is aimed at the development of technologies for growing queens, optimal placement of beehives, and optimization of the honey collection process to ensure the maximum production yield [11].

Modern technologies also play an important role in the development of beekeeping. The use of drones and sensor systems allows monitoring the condition of bees and receiving information

about weather conditions, which contributes to better management of the apiary [15]. Automation of the processes of keeping bees and collecting honey helps to reduce labor intensity and increase labor efficiency [13].

According to the current methodology of honey accounting statistics, the total production of honey includes the total volume of honey removed from the hives and left in the hives as a feed stock for feeding bees.

The honey market of Ukraine is one of those, where the supply is almost entirely formed by households, while the share of enterprises in production is quite insignificant. The main suppliers of commercial honey are the steppe and forest-steppe zones, which receive high-quality products of various botanical composition.

The main producers of honey in Ukraine are 8 regions, i.e. Vinnytsia, Donetsk, Dnipropetrovsk, Zaporizhzhya, Zhytomyr, Mykolaiv, Poltava and Kirovohrad. These regions provide production of 70% of the total volume of honey per year in the country. The main sales market for Ukrainian honey is the EU countries, to which more than 77% of the total exports to the world market were exported in 2018-2019 [4, 2].

The demand for this product in the EU is quite high, because the quotas for its supply (5.8 thousand t in 2020 and 6 thousand t in 2021, and from October 1, 2017 an additional 2.5 thousand t in year) are exhausted in 2-3 days, although domestic exporters consider the optimal amount of quotas to be 20,000 t. Indeed, the main factors of the favorable situation are, first of all, the availability of the European market and the low price of Ukrainian honey compared to the leading countries. In the last decade, Ukraine managed to increase the volume of honey exports to the world market by 10 times and bring the share of Ukrainian honey to 7.3% [1].

One of the important aspects of the development of beekeeping is the search for new sales markets. The growing popularity of organic products and the increase in awareness and awareness of consumers about the benefits of bee products contribute to the expansion of sales markets [6]. Research in the field of marketing and the development of new sales strategies contribute to the effective promotion of beekeeping products on the market [10].

Therefore, first of all, the dynamics of the number of bee colonies in farms

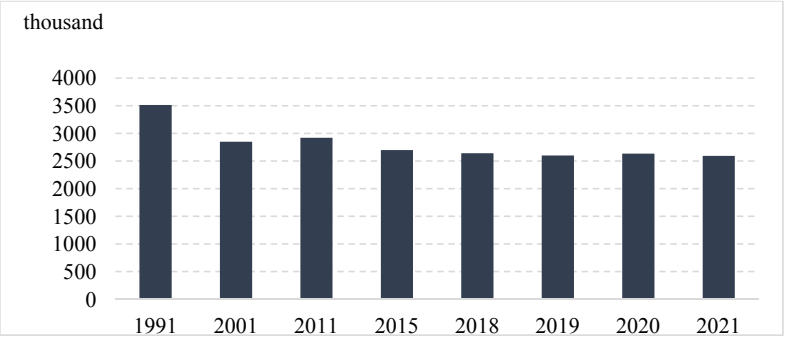

Fig. 1. Dynamics of the number of bee colonies in farms of all categories of Ukraine

Source: Own representation based on data [2].

1. Dynamics of honey production in all categories of enterprises in Ukraine

Production / years	2000	2010	2015	2018	2019	2020	Percentage value of 2020 to 2000, %
Enterprises of all categories	52439	70873	63615	71279	69937	68028	130
Enterprises	3464	1620	918	890	787	655	18
Farms	83	215	120	120	98	84	101
Households	48875	69253	62697	70389	69150	67373	138

Source: Own representation based on data [2].

of all categories of Ukraine in 1991-2021 were considered (Fig. 1).

As we can see from fig. 1, the tendency towards a decrease in the number of bee families in Ukrainian farms is generally maintained. The decrease in the number of bees in Ukraine is the result of several factors that affect the health and viability of bees. The main causes of bee population decline include:

– use of pesticides, where their application in agriculture can have a negative effect on bees. Pesticides can be toxic to bees, cause deterioration of their health and contribute to the extinction of colonies;

– loss of natural environment, i.e. destruction of natural habitats, including meadows, fields and forests, reduces the availability of bees to honey plants for food collection. The destruction of ecosystem biotopes leads to the loss of the diversity of plants from which bees obtain pollen and nectar;

– diseases and parasites. There are various diseases and parasites that affect bees, including Varroa destructor, Nosema spp., American and European viral diseases. These diseases can lead to depletion of colonies, reduction of honey productivity and death of bees;

– use of non-ecological practices in beekeeping. Uncontrolled use of antibiotics and other chemicals in beekeeping can have a negative impact on bee health and contribute to the development of drug resistance. Also, uncontrolled movement of apiaries can contribute to the spread of diseases and stress in bees.

– climate change. Climate change can affect the availability of food for bees and lead to plant shortages. Extreme weather conditions, such as heavy rains, droughts and extreme temperatures, can also negatively affect the health and survival of bees.

The change in the number of bees in Ukraine is a complex problem that requires an integrated approach. To preserve and protect bees, it is necessary to use environmentally friendly beekeeping methods, reduce the use of harmful chemicals, preserve natural biotopes, and work on the development of sustainable bee breeds.

Despite the decrease in the number of bee colonies, honey production is increasing. This increase is generally in households, while honey production in enterprises is decreasing, and is about 18% in 2020 compared to production in 2000 (table 1).

In 2020 the majority of honey production (98.9%) came from households, while only 2% was produced by registered economic entities, as shown in table 1. This creates significant complexity in the market in terms of determining the number of producers, the volume of honey produced and origin of products.

2. The cost structure of production of natural honey in agricultural enterprises of Ukraine in 2020

Costs	UAH per1 kg	Share to the total costs, %
Total costs	95.3	100.0
Direct material costs in total, where:	33.1	34.7
-feed costs	21.1	22.1
-costs for fuel	2.1	2.2
-another material costs	9.9	10.4
Direct labor costs	42.3	44.4
Other direct and general production costs in total, where:	19.9	20.9
-deductions for social events	9.1	9.6
- depreciation	6.3	6.6
-payment for the services of third-party organizations	1.2	1.3
- rest are other direct and general production costs	3.2	3.4

Source: Own representation based on data [2].

According to the data of the State Statistics Service of Ukraine, in total there are about 3 million bee families in various categories of farms in the country. In the early 2000s, honey production at enterprises was 6.8%, which was higher than in the subsequent period. Since 2005, there has been a gradual decrease in honey production at enterprises from 3.4% to 1.1% in 2020.

This is primarily related to organizational and technological problems. In particular, the weak mechanization of the main production processes, which caused the increase in the cost of production, and therefore its unprofitability in agricultural enterprises. This creates considerable complexity in the market in terms of determining the number of producers, the volume of honey produced and the origin of the products. In table 2 is presented the cost structure of production of natural honey in agricultural enterprises of Ukraine in 2020.

Analyzing the cost of honey production in 2020, it is noted that the main component of costs is labor wages, which is 44.4% of total costs, while other costs account for a relatively small share.

Optimizing honey production involves detailed analysis and management of various factors that affect the production cost. The vast majority of studies in this area show that the costs of honey production vary greatly depending on various factors, such as the scale of production, regional conditions, technology and cultivation practices [19].

Among the main components of honey production costs, the following elements should be highlighted:

– equipment and supplies. Honey production requires the use of various tools and equipment, such as hives, frames, and other means of collecting honey. The cost of purchasing or maintaining this equipment can significantly affect the overall costs of the apiary;

– queen bees and bee colonies. The cost of purchasing new queen bees or breeding new bee colonies is one of the key costs for a beekeeper. Optimum colony management can reduce costs and improve apiary productivity;

– bee feed. When natural nectar re-

sources are limited, providing bees with sufficient nutrition becomes an important task. Forage and bee health maintenance costs are determined by seasonality and availability of resources;

– veterinary care and disease control. The health of bees determines their productivity. Disease prevention, regular check-ups and treatment can further increase the costs of the apiary;

– infrastructure. Hosting an apiary requires infrastructure costs such as water and electricity. These costs depend on the location of the apiary and the availability of the necessary resources;

– marketing and sales. Selling honey and its products requires marketing, packaging and transportation efforts. The costs of advertising campaigns, packaging and delivery of honey can affect its final price;

– administrative costs. The costs of running an apiary include employee wages, insurance, accounting and other overhead costs.

Optimizing these components can help improve honey production efficiency and reduce overall costs. Research in the field of beekeeping economics provides important data and tools for beekeepers to make informed decisions about optimal management of their apiary.

This aspect emphasizes the importance of the development of mechanization and the introduction of innovative technologies in the honey production process. The introduction of modern equipment can significantly increase the competitiveness of products. In addition, in the future, it is worth focusing attention not only on the production of honey, as the main product of the beekeeping industry, but also on its processing into products with a higher added value. That is, the formation of an effective agro-industrial innovation model to achieve sustainable development of the industry) [19].

The quantity of honey and its price depend on the volume of supply, the sales structure, the consumer's ability to pay and the season of sale. According to the data of the Food and Agriculture Organization of the United Nations (FAO), during the analyzed period there is a general trend of increasing sales prices for honey that encourage producers to increase honey [8].

Beekeeping products can have a high added value due to their unique characteristics, useful properties and popularity among consumers. Such products include: honey collected from rare or exotic flowers can have an exquisite taste and aroma, which makes it a valuable product for gourmets; propolis, used in traditional medicine and cosmetology due to its antiseptic and anti-inflammatory properties. Propolis can be the basis for the production of various balms, creams, ointments and supplements for cosmetics; flower pollen, which contains many nutrients and vitamins, so it is used as an additive to food products, dietary supplements and sports mixes; royal jelly is considered beneficial for health, as it contains many biologically active substances. Royal jelly-based products, such as capsules or extracts, can be of high value to consumers; bee venom contains specific components that can be used in medical preparations to treat joint diseases and reduce inflammation; beeswax and bee honey used in the cosmetic industry for the production of creams, balms, detergents and other cosmetic products; cordyceps is a fungus that is parasitic on bees. It has potential medicinal properties, so products based on it can have high value [7].

These products have high added value due to their unique characteristics and

beneficial properties, which can satisfy the demand for quality and useful products among consumers [17].

Organic honey also plays an important role. Organic honey is honey that is produced using organic farming methods, where there is no use of synthetic chemical fertilizers, pesticides, and other chemicals [9].

Organic beekeeping has already been implemented in sixty countries around the world. It is based on the same principles as organic farming and is more costly than conventional beekeeping, and organic products are much more expensive.

In the EU, the production of organic honey is regulated by the respective decrees No. 889/2008 and No. 2029/91. In Ukraine, beekeeping is regulated by the Law of Ukraine «On Beekeeping», and the quality and safety of honey is regulated by the state standard (DSTU 4497:2005). Organic honey production is subject to the Resolution «On Approval of Detailed Rules for the Production of Organic Products (Raw Materials) of Beekeeping» («Organic Standard», 2007; «Detailed Rules for the Production of Organic Products (Raw Materials) of Beekeeping», 2016; Law of Ukraine «On Basic Principles and Requirements for Organic Production, Circulation and Labeling of Organic Products», 2018) [3, 12, 16].

The largest consumers of honey in the world (both organic and non-organic) are South Africa, New Zealand, and European countries. Ukraine is also among the top 10 consumer countries per capita.

In terms of retail sales of organic honey, the leaders are Germany, France and the United States, where more than USD 90 million of organic honey is sold annually in each country. At the same time, the most dynamic average annual growth in retail sales over the past 5 years has been demonstrated by the United States (almost 30% growth), France (12%), Sweden and Finland (8% each).

The production of organic honey is based on creating a favorable environment for bees, observing natural cycles and preserving biological diversity. Organic honey has some special advantages that make it attractive to producers and consumers:

– absence of chemicals. Organic honey is produced without the use of synthetic chemical fertilizers, pesticides and other chemicals, which makes it more environmentally friendly and safe for consumption;

– higher quality and taste. Organic apiaries are usually located in natural ecosystems where bees have access to a variety of flowers and plants. This can positively affect the taste and quality of honey;

– growing demand. Global demand for organic products, in particular honey, is steadily growing. Many consumers consider them safer and more beneficial for health;

– export opportunities. Ukraine has the potential to become an important producer of organic honey for export, especially to European markets, where demand for organic products is high.

– preservation of biodiversity. Organic production contributes to the preservation of biodiversity and the maintenance of ecologically balanced systems [5].

Therefore, the development and implementation of innovative approaches in beekeeping can become key factors for increasing production efficiency, developing markets, and maintaining the stable development of the industry. A necessary condition is the planning and

implementation of systemic measures to stimulate and support the innovative potential of beekeeping, which will contribute to ensuring the sustainable development of the agricultural sector and increasing its competitiveness on the world market.

Conclusions and future perspectives of the study.

This study emphasizes the importance of the beekeeping industry of Ukraine as one of the most powerful beekeeping countries in the world. Ukraine has a favourable geographical location and the ability to produce high-quality beekeeping products for domestic consumption and export. The beekeeping industry plays a special role in the agro-industrial complex of the country, providing useful food products and forming a raw material base for the processing industry, as well as contributing to increased productivity through pollination of plants.

The general conclusions of the study are as follows. The beekeeping industry in Ukraine faces various factors, such as the decrease in the number of bees, climate change and external threats. Some problems that require detailed research include the lack of a scientifically based mechanism for the formation and functioning of the market, insufficiently researched issues of the development of market relations between producers, processors and sellers of beekeeping products, as well as limited information about the economic efficiency of production. However, there are prospects for the development of the industry, in particular in organic beekeeping and the use of modern technologies.

Based on getting results of the study, the following measures are proposed: (1) implement comprehensive measures to preserve and increase the number of bees, including measures to protect bees, reduce the impact of pests and diseases, and encourage support for beekeepers; (2) improve market relations in the field of beekeeping by developing a scientifically based mechanism of market formation and functioning, promoting interaction between producers, processors and sellers of beekeeping products; (3) introduce support for organic beekeeping and modern technologies in the industry by developing training and consulting programs for beekeepers on organic production and the use of the latest methods of bee colony management; (4) conduct an economic analysis of the production efficiency of beekeeping products to provide producers and investors with objective data on the potential of the industry and the possibility of making a profit; (5) expand industry research by focusing on issues that require detailed study, such as the impact of climate change, product quality, standardization and certification of beekeeping products.

Measures mentioned above will contribute to the development of beekeeping in Ukraine, ensuring the stable production of high-quality beekeeping products, increasing the industry's profitability, and contributing to the sustainable development of the country's agro-industrial complex.

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СУЧАСНИЙ СТАН ТА ОСНОВНІ НАПРЯМКИ РОЗВИТКУ ГАЛУЗІ БДЖІЛЬНИЦТВА
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Анотація. *У статті досліджено сучасний стан і перспективи розвитку галузі бджільництва в Україні. Україна відома як одна з найпотужніших бджільницьких держав світу завдяки своєму вигідному географічному положенню та здатності виробляти якісну бджільницьку продукцію як для внутрішнього споживання, так і для експорту. Підкреслено особливу роль бджільництва в агропромисловому комплексі України. Галузь бджільництва не лише виробляє корисні продукти харчування, формує сировинну базу для переробної промисловості, а й сприяє підвищенню врожайності ентомофільних рослин сільськогосподарського призначення.*

Для досягнення поставленої мети, використані загальнонаукові методи дослідження, такі як емпіричні, теоретичні, розрахунково-математичні.

Здійснено огляд наукових джерел, статей і публікацій, які стосуються галузі бджільництва, виробництва меду та кількості бджолиних сімей. Це в свою чергу надало можливість узагальнити представлення про ринок меду та визначити ключові аспекти її подальшого дослідження. Для оцінки стану та динаміки розвитку галузі бджільництва були використані статистичні дані про виробництво меду у господарствах населення, підприємствах та фермерських господарствах, а також дані про кількість бджолосімей. Окрім того, були використані розрахунково-математичні методи для комплексного аналізу проблем і перспектив сектору. Загальний висновок статті полягає в тому, що галузь бджільництва в Україні знаходиться під впливом різних чинників, таких як зменшення кількості бджіл, зміни клімату та зовнішніх загроз. Потребують подальшого дослідження питання механізму формування й функціонування ринку меду, питання розвитку ринкових відносин між виробниками, переробниками та постачальниками продукції бджільництва, економічної ефективності виробництва продукції бджільництва. Перспективи розвитку галузі бджільництва полягають у веденні органічного бджільництва й використанні сучасних технологій.

Ключові слова: *виробництво, мед, бджільництво, конкурентоспроможність, продуктивність.*