

# **Strategy of technological development of industrial beekeeping**

## **Industrial beekeeping**

### **Dmitriy Petrov**

#### **1. Foreword**

The program of global cooperation Agenda XXI \*, aimed at achieving two objectives - high-quality environment and a healthy economy for all peoples of the world, declared the need to promote sustainable agriculture and rural development. Taking into account the progressive increase of the world population, the United Nations had concerns about the need to increase food production for mankind. The solution of the problem of satisfying the increasing demand for the production of bee products, the author connects to the opportunity and the need to move manufactured beekeeping in the industrial phase of development, as a result of the intensification of the means of production of bee products, improve the organization and mechanization of production processes.

#### **2. Introduction**

In 2005, the Publishing house University Book in city of Sumy released monograph of doctor of economic sciences, professor, head of the Department of Economics of the Sumy State University, L.Melnik “Methodology for Development”, the ideas of which have enabled the author to find ways to overcome the state of technological stagnation in the modern beekeeping and became the theoretical basis of the strategy of technological development of industrial beekeeping.

For the first time the subject of research of scientists and the public is not an object or phenomenon of society or nature, and even not their state, but the *process of change* called *development*. [1]

Development - the process of moving from the lowest (single) to the highest (complex), the main feature of which is the disappearance of the old and the emergence of a new one. [2]

***Development is the process of moving from the lowest (single) to the highest (complex), the main feature of which is the disappearance of the old and the emergence of a new one.*** [2]

According to the encyclopedic definition:

*“Development is an irreversible, directional, regular change of material (organism, ecosystem, enterprise) and ideal (language, culture, religion) objects.”*[3]

**Irreversibility** is a property of processes to occur spontaneously in a certain direction without the possibility of returning to its original natural state.

**Directionality** requires the ability of system to change in some areas more than in others.

**Regularity** is the property of the system to comply with certain laws. The regularity provides a matching between the changes and the cause-and-effect relationships when under the same circumstances, changes of the system will occur in a certain way, when the same cause at the same conditions (which is essential!) always leads to the same consequences. As an example of such investigation it can be considered state of the system. The same chain of changes at the same initial state should lead to the same final state. [1]

### **3. The objectives of this work**

1. To determine the organizational affiliation and level of complexity of objects of beekeeping, which are supposed to be subjected to the processes of development.

2. The processes of technological development of beekeeping should be implemented strictly in accordance with the fundamental laws of natural science, which determines the direction of the evolutionary processes of living matter and technical progress.

3. To ground the possibility of creating of a fundamentally new technological level of manufactured beekeeping - industrial beekeeping based on the integration of biological and technical resources of the objects of beekeeping in the organizational more complex biotechnical system.

4. To initiate the development and practical use of the new generation of bee houses for apifederation – Microapiary.

5. To propose to the international beekeeping community a project of Microapiary of model “Spasovski Boulevard – XXI” (Sb - XXI), as a variant of integration of biotechnological resources of four (six) apicolony to one apifederation.

#### **4. The fundamentals of beekeeping**

A brief digression into the terminology of beekeeping is necessary, first of all, to establish uniformity in the interpretation of terms and definitions within this paper. But the more it is necessary to overcome the state of terminological distress prevailing in modern beekeeping.

Creating of the fundamentals of beekeeping is traditionally the prerogative of biology, but beekeeping is an applied science, designed to serve one of the branches of the agro-industrial complex (AIC), and to limit ourselves to the biology only is almost impossible. Modern natural science in the last 70 years were enriched by many interdisciplinary sciences (general theory of systems, synergy, cybernetics, methodology of development, complexity theory, etc.), the general procedure of which has become a *systematic approach* to research of objects, systems, and processes. Unfortunately, the scientific progress that led modern civilization to the revolutionary changes and prosperity in many fields of human endeavor has not touched beekeeping, and this knowledge is not used in beekeeping. Outdated set of basic concepts, chronic state of terminology distress, lack of basic commitment to technological development - that is ugly picture of the modern Ukrainian beekeeping.

Progressive changes in beekeeping are not complex intellectual or economic problems. Mode of existence of beekeeping, as well as any other area of human activity (social, economic, scientific, cultural, political and so on) are considered to be permanent (continuous) innovation. [4 page 101] To put it simply: the desire to survive, to be implemented continuous improvement. Beekeeping will cease to be applied science, if not consider alternative hypotheses technology, we must be prepared to abandon the conventions, if they do not correspond to modern notions of reality. Beekeeping need to implement a new round of learning. It's all about the approach, there may be the possibility of using a different technology or not. Without doubt, in the first place, it is necessary to apply a systematic approach to the study of objects and processes of beekeeping. [5]

Further technological development of beekeeping exercise based on **METHODOLOGY OF DEVELOPMENT**, which today is a fundamental theoretical basis for the development of open systems. [1]

The basis of modern biological world view is the notion that the *world of the living is a grand system of highly organized systems*. Any system consists of elements (components) and the connections between them (structures), which combines a given set of elements into a coherent whole. Such a complex organization is inconceivable without integrity. The integrity of the structure is generated by the system, the type of relations between its elements. The integrity of the biological systems is qualitatively different from the integrity of the non-living, and above all by the fact that *the integrity of the self-organization of living matter is maintained during the movement*.

Physical (closed) systems differ from the living entities that are closed with respect to the external environment, while living matter (open systems) are open and enter into the metabolic processes to the environment through the material, energy and information. Biological systems characterized by its specific elements and special types of relationships between them, are often complicated by anthropogenic factor, therefore especially important to a systems approach in applied biological sciences for various branches of agriculture.

#### 4.1. Beekeeping.

The concept of beekeeping, as a branch of agriculture, is determined by the main regulatory document of the state - the state standard for terms and definitions. What is remarkable is that the followers of the post-Soviet (common in the recent past), agricultural science determine beekeeping as fundamentally different concepts.

State Standard of the Russian Federation.

Beekeeping. Terms and definitions. GOST P52001-2002.

**Beekeeping** is a branch of agriculture, engaged in cultivation, maintenance and use of bees for the *manufacturing of bee products* \*\* and pollination of entomophilous crops.

National standard of Ukraine. Beekeeping. Terms and definitions of concepts. DSTU 2154 - 2003. DSTU 2154 - 2003.

**Beekeeping** is a branch of agriculture, which breeds, maintenance and uses bees for *receiving products* \*\* and pollination of crops.

Between the terms “*manufacture*” and “*receive*” there is a significant semantic difference.

***Receiving*** is the change in state ownership of objects with movement in space and time, while maintaining their qualitative and quantitative characteristics.

***Manufacturing*** - is the process of making products by changing the quantity and quality of raw materials, which are affected by forces of production, including labor and means of production.

***Receiving and manufacturing is technologically and chronologically different and incompatible processes.*** Production of beekeeping emphasis that dominates the State Standard of the Russian Federation GOST P52001-2002, fully defines the thrust of beekeeping as a branch of agriculture, while its Ukrainian "colleague" - DSTU 2154 - 2003, the process of production of bee products reserves in an uncertain area. Standards must not contain inaccurate and ambiguous definitions of terms, the more fundamental concepts.

The concept of ***beekeeping is necessary to understand the form of entrepreneurial activity for the production of bee products and services*** with the specific features associated with the use of bees. The concept of ***service*** is to be understood to production, is not amenable to direct metrological evaluation. In beekeeping this is the work of bees for pollination of flowers of various plants.

Linnaeus' attempts to correct a mistake in the original title of ***Apis mellifera to Apis mellifisa \*\*\****, unfortunately, have not been successful, which resulted in a growing sequence of erroneous definitions of terms and beekeeping. The essence of the concepts of ***honey plants, honey productivity, honey collection***, and others do not meet the actual reality that characterizes the natural properties of these objects and processes. Ultimately, as a result of misunderstanding the deep nature of the processes, Ukrainian standards terms and definitions of industrial beekeeping moved into the production sphere of human activity. ***And taken together, the deformation of the fundamental concepts was one of the reasons that prevented beekeeping dynamically, as the industrial activity in the overall economic progress of mankind.***

Production orientation involves the operation of the scheme: raw materials - the means of production - bee products (as a commodity).

Therefore, it is appropriate in the first instance, to determine the production of these fundamental concepts.

#### 4.2. Products and services to beekeeping

Products and services to beekeeping are needed in special comments, except for some clarification. To clear separation degree of participation rights and insects in the production process, it is advisable categorize bee products into three groups: primary, intermediate and final.

***The primary products of beekeeping should include substances produced by bees and that are located in the bees house. #***

People cannot be involved directly in their production but they have a positive (negative) impact directly or indirectly as a beekeeper - to be involved in the formation of anthropogenic impacts on the environment.

***The final products of beekeeping are the commodity, as an object of purchase - sale, market relations between sellers and buyers. #***

***Intermediate bee products should be considered such bee products which are in the process of refining from the primary to the final. #***

***The raw material base*** for the production of ***primary*** products of beekeeping are the biological factors of the planet Earth, in particular, its flora.

***The raw material*** for the production of final products of beekeeping are primary products produced by bees.

#### 4.3. The means of production of bee products

Logically, if there are processes for the production of real goods and services, and there must be means to implement these processes, which are determined by the general notion in any production area of work as ***a means of production***. The concept of ***the means of production of bee products*** in modern beekeeping is missing. Definition or interpretation of this concept does not exist in the scientific (academic) literature or periodicals or in the standards for the terms and definitions of beekeeping in different countries. Fill this gap in the conceptual set of bee is absolutely necessary, because the concept of ***the means of production*** belong to the basic, fundamental concepts of any business.

***4.3.1. The main means of production of bee products (primary and some final) is determined by a single concept - a colony of bees or apicolony. #***

***4.3.2 . Apicolony is a complex organized unity of the family and the home nest of bees. #***

With regard to cultural beekeeping, this definition can be refined so that the dwelling has an artificial origin.

***4.3.3. Apicolony is a complex organized unity of the family and artificial dwelling nest of bees. #***

Apicolony is a biotechnical system (it is made by biological and technical subsystems). Biological subsystem forms a family of bees and brood in all stages of development, the technical sub-system - housing and nest of bees. [Read more at the source 5]

***4.3.4. Dwelling of bees*** limits interior space of apicolony, determines the shape of the nest and is a border environment by means of which the exchange processes between the internal and external environment of apicolony habitat (i.e. *external metabolism*).

***4.3.5. The nest of bees*** is apicolony internal infrastructure as a means of implementing reproductive function, production, and storage resources (reserves) which are necessary for the life of a family of bees.

***4.3.6. Apifederation as biotechnical system of apicolonies, integrates their infrastructure and biological resources into a single biotechnical system. #***

Thus, for use of apifederation, there is need for creating a bee dwellings of fundamentally new architecture that provides a community space for the autonomy of the female reproductive resources. One option of bee houses of apifederation of four (six) apicolony is the project of Microapiary.

***4.3.7. Apifederation in Microapiary is the new generation of the means of production of bee products. #***

**4.4. The family of bees.**

Discrepancy in the definition of *a family of bees*, the proposed standards of various countries indicates that a common interpretation of this concept yet. And the existing options include not only incomplete but often incorrect information, distorting the essence of the primary social system, which is formed as a result of the insect procreation. It makes sense to remind the goal-setting biological organism levels of living matter.

**4.4.1. Targeting of biological objects of organismal level of complexity is to reach the organisms of reproductive age and participation in the processes of reproduction.**

Bees, for that matter, do not pose the slightest exception.

Education for family bisexual members of the animal world - this is the only way to implement procreation.

**4.4.2. A factor which the family is the instinct of reproduction potential breeders. #** The structure of the family, except for loudspeakers may include several generations of their offspring.

**4.4.3. The integrity of the family by the complex genetic relatedness of breeders and their descendants. #**

**4.4.4. The family forms the core of bees productive forces in the production of primary products of beekeeping. #**

It is definitely a cause of disagreement, and it should not. The principal, in the definition of *a family of bees*, should be two factors: a statement of its educational goal-setting and social nature of the relationship of organisms belongs to it.

**4.4.5. Targeting families of bees - the formation of the size and resources of reproductive population. Additionally - the formation of the genetic diversity of populations of the bank. #**

Based on the above, the beginning of the concept of language family of bees can be represented by the following version:

**4.4.6. Family Bee - is an elementary (primary) social system (group), formed as a result of procreation insect species *Apis mellifera*, which included ... etc. #**

Almost determine the composition of the family of bees can be a very simple method. *Complexity theory* as an interdisciplinary science research and prediction of the complex systems, has developed *a method of attractors* (born attract - attract, draw). The essence of the method is to test the system objects in a natural motion, without external control action, i.e. in real conditions of existence. It's enough to fill the hive frames of brood and bees from different families to plant a few ewes and leave the colony without external interference, for more than the lives of two - three generations of bees. The completion of the transition process will inevitably lead to the stabilization of the quantitative and qualitative

composition of the bee colony, which is easy to determine empirically. Genetic relatedness of the uterus with the other members of the family occurs naturally as the queen bee in the family bee *Apis mellifera* is a single reproductive resource. For honeybee typical organization of the family is monogenic. That it contains two or more adult females can be observed only during the period of swarming, when the output of a swarm delayed because of bad weather, and the replacement of the old family of the uterus (silent change). Participation of two females in reproductive performance is sometimes observed in families replacement ewes. But their life together is usually of short duration. [6 p 25]

#### 4.5. Apifederation

Bees, like all other forms of animal life, can form a social system of a different order. An example of such formations can serve the community as a social system of organisms that implement the instinct of self-preservation. A factor which a multi-million, and minority, migrant communities is the instinct of self-preservation, which manifests itself in negative changes in habitat, forcing animals to move to the regions of the planet, natural (climatic) conditions that satisfy their physiological needs. This can be impressive in time and space migration to wintering grounds, breeding, etc. By definition of N.Reimers, *gregariousness* is a form of community of unrelated individuals. [7] In some species of insects, reducing the quality of the environment causes a reaction formation of *federations*. These include ants and bees. Ants, for example, formed the federation by over-population, competition for food resources of the colonies with a shortage of hunting grounds. In a federation, each colony retains its structure.

Under natural conditions, the formation of federations of ant can cause fires, floods, etc. [8]

Almost impossible to natural causes (man-made disasters, natural disasters and other force majeure), which could cause the formation of federations of bees. Bees mobile enough, nevertheless they are capable of forming a federation in the space deficit, which may be created artificially and efficiently used in apiculture. All this is contrary to what we believed in the past. The priority in the creation of apifederation belongs to the British naturalist - beekeeper Wels. [9] Preserving the autonomy of

reproductive resources of two separate colonies, he created a common space, bringing together the internal environment of the two colonies of bees, which led to the formation of a federation of bees.

Probably in beekeeping is the only event that meets the concept of *discovery*. Everything else in importance does not exceed the level of inventions.

***Wels in 1892 first artificially created social system of a higher level of complexity than the family of bees. #***

The main condition of the federation of bees is, the creation of artificial nesting housing space available to bees of all the colonies, except for females. Thus, in the standard list of terms the notion of beekeeping *apifederation*.

***4.5.1. Apifederation is artificially formed biotechnical system of colonies of bees of the species *Apis mellifera* in the creation of a generalized nesting space for a standalone resource apicolony reproductive isolation. #***

***4.5.2. The integrity of the instinct of self-preservation is ensured apifederation bee colonies that can be integrated apicolony. #***

***4.5.3. Targeting of apifederation is ensuring the survival population in the process of natural selection. #***

Apifederation, like any other social community formed by the manifestation of the instinct of self-preservation (biological response to adverse changes in the conditions of existence), it is easy to decompose at eliminating the factors that caused their formation.

Federation in relation to families have a higher degree of socialization (organizational complexity, mainly in the number of individuals integral, meaning that they are more numerous).

***In summary, you need to be clear that the bees of the species *Apis mellifera* can form social systems of various organizational complexity: apicolony and apifederation #***

## **5. Socialization**

***Axiom: In the body, the nature of each one of us has invested no more than half of the capacity needed for the continuation of life. #***

Creating social communities in insects have been repeatedly described in the scientific literature, but a characteristic feature of all sources is that

their authors attribute the emergence of the social needs of the individuals in the creation of a complex infrastructure (construction of nested structures, fishing gear, the excess forage, etc.) which can be formed a single operation. [6] In fact, it was the seed of scientific understanding of the processes that take place in the social systems of living matter that should comprehend minded and unbiased mind. Such behavior of organisms logically explained by the implementation of self-preservation, which in this case is a factor of socialization. However, the two great instinct (*reproduction and survival*), occasionally dominating, determine the behavior of organisms throughout their life, so is the emergence of *sociality* only one instinct, ignoring the other - is unimaginable.

Deliberately leaving open the question of the primacy of a social nature, it is proposed to focus on the fact of the existence of social formations, which are essentially a form of living matter, so it should be a modest level of organization and worthy of a place in the overall hierarchy of organizational complexity of living matter between the levels of organismic and population - species.

Which term best would fit the definition of this level?

In the end, it is important to reflect the essence of system formation principles and mechanisms of self-organization of social systems of organisms.

***Possible variants of terms and definitions:***

***5.1. Socialization level of organizational complexity of living matter - it's an entirely new education (social systems) of organisms (biological systems) that meet the social needs of the latter. #***

***5.2. Backbone factor of socialization - implementation of complex organisms instincts of self-preservation and reproduction. #***

***5.3 Targeting of socialization:***

***Option № 5.3.1. Reproduction (generation) and ensuring the survival of reproductive resources population. #***

***Option № 5.3.2. The formation and maintenance of the genetic bank population. #***

Urgent need of modern beekeeping is the creation of effective intellectual resources development. Biological problems of societies are beyond the laws of science. This is the area of human knowledge, where the majority of the components have not even outlined the formulation of hypotheses, problems, questions, or problems, the complexity of which we are only beginning to comprehend.

Comparative analysis of biological and social systems, the three main components (information, matter, energy), even as a first approximation, shows that there are fundamental differences.

#### ***5.4. The main differences of biological and social systems:***

***5.4.1. The difference between the quality of information that dominates the internal metabolism of information between the two systems, and the material basis of its carriers. #***

In biological systems, self-organization processes are carried out, basically, contact communications subsystems: the movement of own internal environment of the electric potential and substances (hormones, secrets, etc.). By the way, socialization is also characteristic of the contact methods of communication: sensing, trofollaksis, aggregation, mating, etc. [6]

***5.4.2. Biological systems have the property of organismal level spatial Unrequited (real integrity.) #***

Spatial fragmentation of social systems extends the means of communication objects (subsystems), shifting the main flow of internal information metabolism in the area of interactive methods (technology) communications, implemented mainly by mechanical vibrations (e.g. the acoustics) and a broad spectrum of electromagnetic fields (from infrared to high-frequency radio-wave range, including natural bodies of visible light - the light). [10]

***5.4.3. Fundamentally different forms of domestic energy metabolism in organisms and societies. #***

Polymorphism (fixed differences in the performance of different individuals of a certain range of functions in social insects), with distinct manifestations of the "caste" or temporary polietizma - is, in fact, the division of labor in social insects for the extraction, processing and storage of energy resources (reserves) insect societies . [7]

The universe as a system of the highest degree of difficulty, too, can be represented by three components common to all complex systems: matter, energy and information. Information, in turn, the modern human knowledge are also three components: natural science and two areas of problems - the problems of the mind and society. Thus, the information resources of beekeeping are located in two different areas of human knowledge: natural science and sociology. It is logical to assume that the bee-like objects organismal complexity - is the prerogative of the natural sciences (e.g. biology), but the family and the Federation of bees, as objects of social structure is logical to investigate the social scientists as experts in the field of social systems of living matter (e.g. zoosociology).

***Recognized for the family and the federation of bees status of social systems is the Rubicon overcome which, modern beekeeping gets a real chance of dynamic technological development in the third millennium.***

## **6. The laws of motion of matter**

In modern science formulated by at least two laws of motion of matter. They define:

- Direction of the evolutionary processes of living matter;
- Unlimited technical progress.

The most successful, in my opinion, the wording of the law of directed evolution of living matter belongs to the Academy of Sciences of the USSR Nikolay Mikhailovich Amosov.

Citations from private correspondence of N.Amosov and B. Avdyuhov.

***6.1. Law of direction of evolution of living matter, “vector of the evolution is pointing in the direction of more complex systems.”***

***6.2. Law (the regularity) of unbounded progress: “The development from simple to complex has no limit.”***

It is adapted from Encyclopedia dictionary of L.Melnik "Economics and Informatics" p.81. [4]

***6.3. There is a possibility that these two laws (regularities) are the components of a general law of motion of matter, which determines not only the direction but also the unrestricted movement of the matter. #***

But beekeeping is advisable to use them separately to visualize the possibility of the objects of nature and technical systems.

## **7. Beekeeping as a production activity**

The organization structure of the bee on production systems (raw materials - the means of production - the product) will help develop beekeeping with practical experience of production (processing) industry.

Starting from the workplace, the organizational structure is formed on the principle of the system: the team (site) - a system of jobs, the shop - as a system of teams (sites), etc.

### **7.1. Workplace of beekeeper**

There are numerous standards for workplace organization fitters, turners, office workers and other specialties. Why does the beekeeper deny this? What are the means of production of primary products to work in the apiary beekeeper - or rather, in the workplace? What are the means of mechanization can be used for the production of beekeeping beekeeper works? How can we improve productivity? How does the concentration of the means of production at one workplace to go to the integration processes of biological and technical resources?

The resolution of these and other issues related to the organization of the workplace beekeeper is essentially stages of technological excellence beekeeping in general, as an amateur, and industrial.

***Working place for the production of primary products of beekeeping is a plot, point, with an arranged on it means of production of primary products of beekeeping (apicolony or apifederation), equipped with technical means of mechanization and equipped with everything needed to perform a specific job. #***

### **7.2. Technological development prospects of beekeeping**

System structuring and formation of higher levels of organization of production, as the previous system complexity, will help to understand one very simple truth, the meaning of which is in the two above-mentioned laws of natural science.

***Achieving a high degree of perfection is possible only in one way - to the increasing complexity of existing systems.***

Natural selection and the competition of the market economy firmly carry out the optimal limits on the complexity of the biological and economic transformation, i.e. excess (especially in technical systems) complexity, ultimately controlled by the external environment.

The structural and functional complexity of the system and the degree of complexity of its control are different concepts. Ease of operation is achieved only complication of self-organization, therefore, a common complication of the latter. The inability to distinguish between the complexity of managing the complexity of the system, control system, lack of knowledge of the laws of development of the system leads to the degradation and decline. Synergetic of Hermann Haken, as the theory of self-organization of open systems in beekeeping has not yet been applied in vain. Often simple systems require complex control and vice versa. For beekeepers is an obvious practice of bumblebee-keeping. Bumblebee - single biological entity. The system is extremely simple. But experience has shown that organize the production of honey in large volumes, exploiting a simple system that failed. A bee family as a social system, in excess of a single bumble bee in the tens of thousands of times (only on the number of individuals) is successfully used by man for thousands of years.

Summing up the results of the economic analysis of beekeeping, it is necessary *to recognize the bee-keeping as an economic activity of the production*. This will be used in the technological development of beekeeping whole experience of modern civilization in the production of human activity. Since then, prospects of technological development of beekeeping do not pose a difficult intellectual problem. It is proposed to move from the terra incognita in routine economy. Routine ... Because beekeeping is so backward in development, that economic innovation even of nineteenth-century become relevant and demanded for it. Methodology for development of beekeeping can be a mediocre rip-off: the need to borrow primitive progressive methods of development in the industrial manufacturers in various industries, outstanding achievements are worthy of emulation.

Artisanal and industrial production in beekeeping has been disbursed. Ukraine owned artisanal producers of 87% of the production of bee products (bee colonies), ranked 5th in the world in the production of honey. This is a great example of an organization of artisanal bee. Canada shows a classic example of a Pareto distribution: 20% of manufacturers operate 80% of the means of production (bee colonies). It is the similar

situation in the beekeeping of Australia and the United States. Modern industrial beekeeping sector is based on extensive production technologies, i.e. in the objects of economic activities have focused considerable financial and operational resources. But the fundamental technological innovation has not happened yet. Is it that there were trucks, working with a group of L. Langstroth beehives installed on the pallet. Probably not very logical to bring the apiary forklift (forklift mounted on the towing a trailer) to move a group of hives placed on the pallet (pallet), and at the same time with cases of individual hives to work manually. In this day of moving heavy load for one beekeeper can reach 7-8 tons.

Such technological inadequacy allows determining of the main contradiction of modern industrial beekeeping.

***7.2.1. Inconsistency sufficiently high level of mechanization of labor-intensive work and legacy, low-end appliances beekeeping. #***

This is the main contradiction of modern beekeeping great allowed transition to an industrial beekeeping that:

- Eliminates beekeepers from hard physical labor;
- Repeatedly increases productivity through mechanization of production, intensification of production equipment and processes in time and space.

The industrialization of the industry has led to the problem of modern civilization overproduction in many categories of goods and services. Why in beekeeping should be like that anyway?

***What needs to be done to build industrial beekeeping?***

***A major reform is necessary to make the workplace a beekeeper with the basic means of production of bee products - bee colonies.***

***7.2.2. The transition from the concentration of the means of production to their integration, i.e. put into practice industrial beekeeping generation change the means of production of primary products (pallet with a group apicolony gives way to an apifederation).***

***7.2.3. Create a new generation of bee houses; technically implement the integration of biological and technical components of apicolony to one apifederation. Microapiary is a possible option.***

**7.2.4. Create a new generation of mechanization of labor-intensive process that meets the design features Microapiary.**

## **8. Prospects for the development of bee houses**

Modern industrial beekeeping in most of the world operates multihull hives, constructive ideas which are based on the invention of Lorenzo Lorraine Langstroth.

### **8.1. Lorenzo Lorraine Langstroth hive**

L. Langstroth hive, which is dominant in the industrial beekeeping, has more than half centuries since its creation. Brilliant simplicity of its design allows beekeepers to date effectively operate a colony of bees, without resorting to the technical means of mechanization, as the complexity of the technological processes is consistent with the physical capabilities of the human body.

Amazing longevity invention of L. Langstroth, in my opinion, is due to three advantages of the design:

**8.1.1. Multihull L. Langstroth hive as a technical system** consists not only of the elements. \*\*\*\* The main component is a *hive body*, as subsystem, created on the *principle of self-similarity* (in essence - multiple effect hive body is a fractal). \*\*\*\*\*

Housing, withdrawn from populated bee hive as part of the subsystem consists of three components apicolony (houses, nests and bee colonies).

8.1.2. A *subsystem* plus the *unification* of *body design* allows the beekeeper enormous technological possibilities in the creation of various combinations of biotechnical resources across the apiary (bee farm, etc.).

8.1.3. *The integrity* of the hive, as a technical system, providing a simple and universally accessible means - the Earth's gravity.

### **8.2. Microapiary**

**8.2.1. The basic idea Mikropaseki - structurally realize the integration of multi-hives in a single technical system. #**

Elements of integration in the construction of bee houses appeared in 1892, when Mr. Wells was first used element of bee home (store), which created an overall internal space for the two colonies (i.e. it is essentially a superstore). With the introduction of beekeeping road trucks appeared element that is capable of integration function for a variety of goods

relative to the loader - this pallet. Pallet - an intermediate element between the load and the means for its spatial displacement. Gravity keeps the surface of a wide variety of pallet loads, i.e. temporarily created an integrated technical system of any degree of complexity, but it is monotonous, easily interacts with the truck. But! in the practice of American Beekeepers, a group of 4 hives practically cannot be removed from the pallet, i.e. on the same pallet same hives are transported to another point or wintering, wherein on the same pallet and winter. In fact, the pallet has become a common feature, which integrates a group of hives in a technical system.

So, now the beekeeping has active two designs, integrates elements of bee houses: the superstore Wels pallet.

Microapiary is structurally complete integration processes of bee houses of several colonies of bees, thus allows for spatial and temporal integration of production processes peculiar to industrial production. [11]

### ***8.3. Architecture Microapiary***

The increasing complexity of the social organization of objects beekeeping operation, naturally leads the overall complexity of the infrastructure. In accordance with the laws of development, in particular the laws unlimited progress (6.2), a progressive change of generations the means of production implies an increase of technological excellence, achieved only increases the complexity of the technical system, compared with the previous one.

However, the practical implementation of the project will require specific technical optimization of its complexity at the lowest possible level. The quest for technical simplicity, combined with efficient functionality, is the defining criteria Microapiary as an architectural ensemble of a number of bee hives.

Microapiary continues the architectural traditions of the hive multiple effect: increasing the amount of internal space of apicolony is also produced in the vertical direction by setting the same type of buildings (superstores). This continuity is maintained in a constructive plan of Microapiary dignity legendary genius invention L.Langstroth. (8.1.)

By analogy with the multihull hive of L.Langstroth, stored energy source, providing structural integrity of Microapiary is the gravity of the

planet Earth. The same dimensions and standardization of technical subsystems (elements) of Microapiary allow you to keep the technological advantage in the creation of various combinations of biotechnical resources on the scale of the apiary (bee farm, etc.)

The practice of industrial beekeepers to isolate the queen bee in the lower frame hive is applicable in Microapiary. But this raises the possibility of creating a common store for all the colonies of apifederation, which amounts to no less than 50 frames. Thus, the amount of disposable manufacturing operation with stores, compared with the colonial system of beekeeping, increased by 5 times, which is equivalent to a five-fold increase in productivity. The number of simultaneously transferred superstores limited to technical characteristics of mechanization. Federated beekeeping to avoid significant loss of working time that inevitably arise when dealing with small objects, i.e. apifederation operation allows the temporary integration of production processes. This is additional reserve margin of growth of industrial beekeeping.

Architecture of Microapiary is tolerant to diversity standards hive frames used in the world of beekeeping practice. Create a square in terms of body shapes base, superstores and other structures, greatly simplifies the work of staff and maneuvers equipment when working with Microapiary.

Spring works with bees include sanitary - hygienic measures, which consist in getting rid of the hive dead bee and litter that had accumulated over the winter at the bottom of each colony. This problem can be solved in three ways:

8.3.1. Uniform bottom of Microapiary may be replaceable.

8.3.2. Microapiary base can be made with a deep under-frame space for each colony, in which to place on the winter-time compilation hive litter. This design creates a spatial zone in the nests, relieves club wintering bees from contact with disadvantaged in respect to sanitary, environment. In this high position notch gas exchange provides year-round nest. On a normal summer under-frame installing floor space is provided. Access to under-frame space can be done from the side.

Given the one-shot spring audit, this process step is feasible. As compensation for some inconvenience in the production of spring work, it is necessary to take into account the fact that the increased under-frame

space contributes to the stabilization of temperature and humidity conditions of hibernation and have a positive effect on the survival of the colonies. During long distance transport of bees, spacious under-frame space can be used to improve the microclimate in the nests of apicolony.

(Project Sb - 2008) or by the entrance side (Project Sb - 2012).



*Fig.1. A deep under-frame space (Project Sb - 2008)*

8.3.3 Perhaps a combination of the two methods - bilateral disposables bottom, one side of which has under-frame space for the summer, the other - for the winter.

Architecture production and housing complexes for apifederation may reflect different ideas, concepts, according to the technological challenges of designing. Microapiary in this aspect is primary and basic design - a minimal module, have a certain potential to develop into a more complex technical systems.

#### 8.4. Microapiary “Spasovski Boulevard – 2008” (Sb - 2008)

The age of the project “Sb – 2008” is more than 15 years. Difficult childhood and adolescence of this project is behind. Working on simple, at first glance, the technical system, it is difficult to imagine that design research have leaded to more than one could imagine. Projecting this design purely from the point of view of an engineer, a vision of how it can

be done, not so much changed as the target destination of the project. Sometimes the work came up against a dead end or choking began to sink in the flow of information, but a sense of confidence in what we are talking about - it's extremely important, forced to continue to study. Monograph L.Melnik "Methodology Development" for the project "Sb – 2008" became a symbolic thread of Ariadne, which allowed not only to complete technical projects of Microapiary, in fact - to search for ways to develop industrial beekeeping and demonstrate the ability to create industrial beekeeping that, in the end in order of importance, significantly higher than the original plan.

Microapiary "Sb – 2008" is a royal residence for the federation of bees, which unites four of the colony, has three years of successful operation. To date, the design idea of the project "Sb – 2008" partly out of date, however, he retained the capacity not only to development, but also for practical application in its original form.

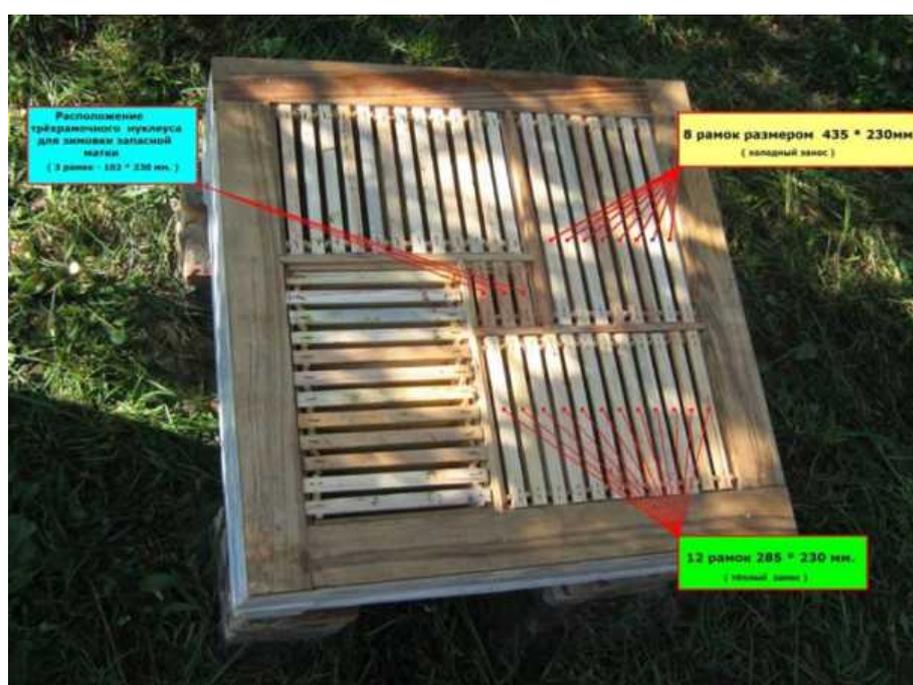
Overall dimensions of the base body, superstores and caps - are the same, by analogy with the classical architecture of the hive, L.Langstroth.

#### 8.4.1. Housing base of Microapiary "Sb – 2008"



*Fig.2. Housing base of "Sb – 2008"*

The housing socket bases four colonies, separated by solid partition walls. This is a reproduction of the nest colonies, bounded above by dividing bars. Uterine space colonies reproductive never leave. Each colony has its own individual entrance is. Cross-section of the base nests in terms of rectangular 300 x 450 mm. Volume base slots depends on the size of frames (eight frame length 435 mm, twelve frame length 285 mm.). Select the height framework finally determines the amount of reproductive nests. In the center of Microapiary “Sb – 2008” is formed a small square in plan cavity, the purpose of which is not completely defined. Originally it was planned as wintering nucleus with backup queen bee. But experiments of Ukrainian beekeepers - innovators V.Malykhin and M.Milenin brilliantly solved the problem of wintering reproductive reserves the apiary and the issue of the use of the central cavity of Microapiary “Sb – 2008” again remains open. Nests in the housing base are removable floor that is removed for the winter, forming a spacious under-frame space allowing placed under the jack disposable litter collections hive. High positioned notch eliminates clogging its dead bees. Each colony has two exterior walls. In summer, the other at the bottom has an opening through which access under-frame space and is equipped with closable lid. The outer wall of the base thickness of 100 - 110 mm, provide thermal insulation, allowing the bees to survive in the harsh climate.



*Fig.3. Filling of the reproductive space of nests with frames of various sizes (435mm • X, 285mm. • X).*



*Fig.4. The cover gives access to under-frame space of nests in the housing base of Microapiary “Sb – 2008”*

#### 8.4.2. Superstore of Microapiary “Sb – 2008”



*Fig.5. Superstore “Sb – 200” contains 52 frames 435mm. • Xmm.*

The design of superstore reflects the desire to achieve universality in the use of it in the framework of different standards, up to simultaneous placement of two types of frames of the same height. Support beams must first provide a framework tightness in static and dynamic modes of

operation of Microapiary. Part of shop space under the beams can be used for the production of honeycomb.



*Fig.6. Superstore “Sb – 200” contains 78 frames 275mm. • Xmm.*



*Fig.7. Absolute tolerance of superstore “Sb – 2008” allows, if it is necessary, correctly to fill its space within the various standards.*



*Fig.8. Element of dock of superstore “Sb – 2008” with the forklift lifting devices.*



*Fig.9. Microapiary “Sb – 2008” is ready for the wintering.*

## 8.5. Microapiary “Spasovski Boulevard – 2012” (Sb - 2012)

The age of the project “Sb – 2012” is not more than 2 years old, his preferred use is expected in the batch beekeeping. Creating a project “Sb – 2012” was due to the knowledge to develop the standard equipment for industrial beekeeping. This should be a set of criteria, rules and regulations for specific technical projects, united by the same technological concept, the system of standards and maximum unification of elements and subsystems. The main criterion for determining the geometry of all the elements and subsystems of Microapiary “Sb – 2012” should be the unification of dimensions for example multiple effect hive L.Langstroth.

For the organization of internal space required for Microapiary it was necessary simple mathematical research, which has resulted in “Theoretical basis of the organization of space of apifederation” (TBOSA).

### 8.5.1. Fragments of TBOSA

The primary task of any theory are the problems of metrology research object, so TBOSA proposes to introduce a unit of linear measurement of internal space of apifederarion (apicolony), which name the "*apimetr*" and designate «*Am*». Take the value of the "*Am*" is equal to the distance between adjacent cells of mediastinum.

$$Am = 37.5 \text{ mm.}$$

**Matrix  $26Am * 26Am$**  is a coordinate plane for Microapiary, which will be located the nest colonies of apifederation in future. (Fig.10).

Nests may be equal or different numbers of hive frames. Matrix  $26Am * 26Am$  is also the basis for the design superstore. Assuming a sufficient amount of brood in the amount of eight hive frames on the matrix  $26Am * 26Am$  can be positioned six nests with tap holes in different directions, "the cold drift" (Fig.11, pos.3)

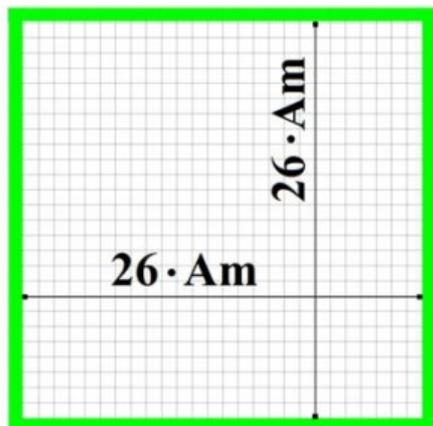


Fig.10.

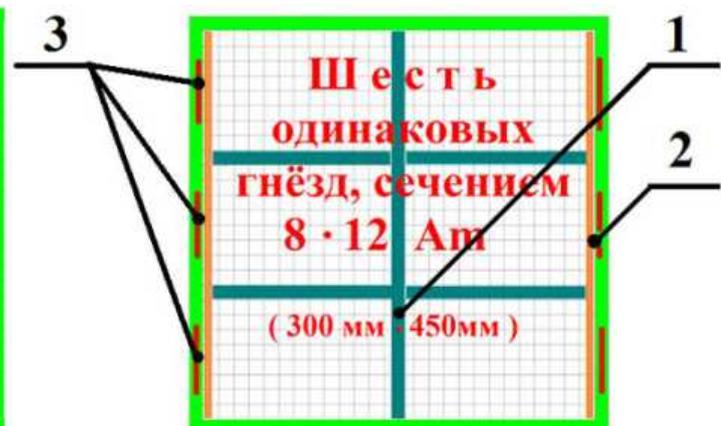


Fig.11.

Partition walls have a thickness equal to  $A_m = 37.5 \text{ mm}$ . Condition square horizontal section of Microapiary can be done in two ways:

- An increase in the width of the partition (Fig. 11, pos. 1);
- Increasing the thickness of the outer wall of the tap-hole (Fig. 11, pos. 2).

Superstore is planned for the same matrix  $26A_m * 26A_m$  with a central support beam. Its size is 52 frames long 435mm.

#### 8.5.2. Housing base “Sb – 2012”

Currently, design work on the project “Sb – 2012” is in the final stage. There are two versions of the base case design:

- Without the bottom (i.e. the bottom of the project “Sb – 2012” unified and disposables);
- An integrated body design with a bottom base (with a deep under-frame space for each colony, which is placed on the winter-time compilation hive litter). The housing base “Sb – 2012” can accommodate the brood of six colonies (Fig. 11.) Volume of nests depends on the size of the base frame (eight frames 435mm long, twelve frames of length 285 mm.). Select the height framework finally determines the amount of reproductive nests. The thin outer wall restricts the operation “Sb – 2012” to temperate zones. Additional external insulation can move up “Sb – 2012” in the higher latitudes.

#### 8.5.3. Superstore of Microapiary “Sb – 2012”

Superstore of Microapiary “Sb – 2012” by design is similar to the project “Sb – 2008”, the internal dimensions of the matrix are determined  $26A_m * 26A_m$ . The external dimension (s) of the bottom, the housing base and cover superstore project “Sb – 2012” is the same.

### 9. Microapiary “Spasovski Boulevard – XXI” (Sb - XXI)

The project “Sb – 2008” was carried out by engineering intuition rather than on clearly conscious purpose, without the assumption of its features which have - or technological perspective. In a further development “Sb – 2008” took a reconsideration of its technological capabilities and a minor upgrade of all the elements and sub-systems, which resulted in its design in line with the overall system standard equipment for industrial beekeeping.

The project “Sb – 2012” had a certain theoretical basis - TBOSA and specific technology-oriented development, which has become a reference point perspective to create an industrial beekeeping.

Microapiary “Spasovski Boulevard – XXI” (Sb - XXI) formed a synthesis of the two projects (“Sb – 2008” + “Sb – 2012” = “Sb – XXI”) in a technical system equipment for the industrial technology of beekeeping. Currently, there are two ways to implement the project «Sb - XXI».

9.1. The classical pathway of the project (Sb-XXI) suggests defining the specific dimensions in line with TBOSA.

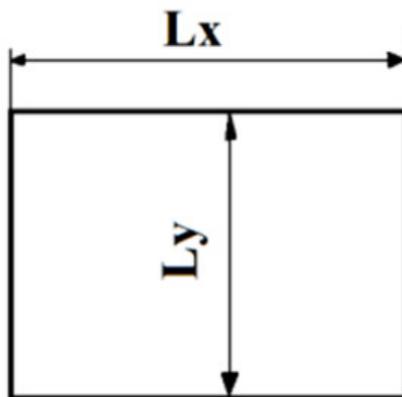
***For rectangular cross sections in terms of bee nests, it is necessary to introduce the concept of "tolerance."***

9.1.1. Tolerant - called rectangular bees nest if both its size is integrally divisible by apimetr - «Am»,  $L_x: Am = k$ ; where  $k = 0, 1, 2, 3$ , etc.

$L_x$  - one of the linear dimensions of the cross section nest of bees;

$L_y: Am = g$ ; wherein  $g = 0, 1, 2, 3$ , etc.

$L_y$  is other linear dimension of the cross section nest of bees.



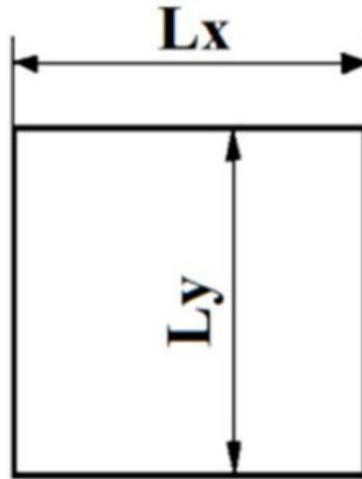
*Fig.12.*

As an example of tolerant is socket sizes 450mm horizontal section. \* 300mm. (projects of Microapiary “Sb – 2008” and “Sb – 2012”).

In the case of equality of values of  $L_x = L_y$  (i.e. a form of horizontal section of a square socket) it calls an absolute tolerance.

***9.1.2. Is called a jack tolerant in terms of square cross section, if the equality***

***$L_x = L_y = k * Am$ ; where  $k = 0, 1, 2, 3$ , etc.***



*Fig.13.*

Examples are absolutely tolerant bees nest horizontal section: 300mm. \* 300mm, 375mm. \* 375mm, 450mm. \* 450mm. etc.

*For the framework it is necessary to introduce the concept - adequacy.*

*9.1.3 Frame is called adequate if its length corresponds to any section tolerant socket.*

*Therefore*

*$L_r = k * A_m - 15 \text{ mm}$ , where  $L_r$  - frame length;*

*$k = 1, 2, 3$ , etc.*

Examples of an adequate framework for the scope are hives of the Dadant - Blatt (435mm. \* 300 mm.), Korablev (285mm. \* 450mm). [12. page 16]

*9.1.4. Basing the design of the horizontal section of the matrix 26Am • 26Am (Fig. 10), we can determine the internal dimensions of subsystems Microapiary (Sb - XXI): the size of the bottom, the base body, superstores and cover, which should be standardized and equal to  $26 * A_m = 975\text{mm}$ .*

This path is appropriate for countries that do not have advanced production equipment for industrial beekeeping. If there are prospects for agricultural development, such countries will have to create industrial beekeeping is virtually a "clean slate." This advantage must be used strategically.

9.2. Pragmatic way of implementation of the project (Sb - XXI) is preferable for countries with well-developed industrial sector beekeeping.

The basic element for determining the size of the component parts of the project of Microapiary “Sb – XXI” should be a standard frame shop, which is adequate technological lines for printing combs, honey extractors, and other equipment of bee farm. The cost of the process equipment is large enough, depreciation periods - are calculated for decades, so the economic feasibility considerations suggest a solution: keep the standard frame shop. The next step is to determine the structure and size of superstore. It should be recalled that it must be square. Mismatch superstore property absolute tolerance (see 8.6.1.2.) Can be neglected, because the uterus it does not work. A possible solution to the problem is to design a square adjacent wall thicknesses superstore.

After determining the size of superstore, we should define the insulated housing base. Housing base of the project “Sb – 2008” is insulated with the working title "Eskimo" and the project “Sb – 2012” has title "Papuan".

Depending on the choice for insulation, in the image and likeness of the project «Sb - 2008" and «Sb - 2012" to construct housing base, bottom, roof, etc. (See Figure 9.)

#### **10. Industrial beekeeping is:**

*- Transition from individual use of apicolony to apifederation, i.e. exploitation of bees in the social systems of a higher order of complexity and organization.*

*- The move to the new generation of bee houses - Microapiary as production and housing complex of apifederation which allows the processes of spatial and temporal integration of biological and technical resources apicolony.*

*- Avoiding the use of beekeepers as a source of mechanical energy in the production process. It had carried a positive shift of personnel qualification, from manual labor to management by means of mechanization of labor-intensive work.*

#### **11. Conclusion**

*Bee products should not remain drug or treat, they should be food available for every person on our planet Earth, especially in children. I*

*am deeply convinced that this transformation is able to make a breakthrough in the beekeeping area of high technology.*

*Are you ready to change your vision of the present and the future of beekeeping? Not necessarily immediately answer that question. Regardless of whether you agree with me or not, this information will forever change your view of modern beekeeping.*

*I'm willing to give up everything, it seems to me certain, if someone - or convincingly proves the opposite. All of us have to give up much of what we previously believed and create a whole new science, which will serve the new beekeeping third millennium.*

*We need a new school of beekeeping - the brave and talented scientists, and it would be extremely important that they have not been made or attached to the ideas that have held back the development of the previous generation.*

## 12. Notes

# - Here and throughout the text - the author's choices of terms and definitions.

\* - Agenda for the XXI century - a program plan (program) of Action adopted by the United Nations (UN), with the goal of sustainable development in the XXI century. The program has been adopted on the basis of the agreement reached at the conference in Rio de Janeiro by 179 states. Material is from Wikipedia.

\*\* - Bold made by author.

\*\*\* - In 1758, the tenth edition of the "System of Nature" Carl Linnaeus was first the name *Apis mellifera*, which translated from Latin means *a bee that brings honey*. First editions of "System of Nature," up to 13th in 1974, adjusted, corrected and supplemented by Linnaeus, which required enormous effort, time and courage to recognize some of the mistakes that he found and tried to fix it. One such error was the determination - *Apis mellifera*. The consequences of this error can be traced to the present, and the restoration of scientific truth will require a lot of time and effort. This error is introduced into the theory and practice of beekeeping error that was the cause of an inert beekeeping development in the last 200 years and a modest level of its modern achievements. The twelfth edition of the "System of Nature" was published in 1766. Among other changes and additions to Linnaeus proposed to change the name of the *Apis mellifera* on *Apis mellifisa*, which translated from Latin means -

*a bee makes honey*. However, more commonly accepted first Latin name bee - *Apis mellifera L.*

\*\*\*\* - Element (from Lat. Elementum - element, the original substance) in the author's interpretation is an irreducible component of technical systems. Cleavage (dissection) of the element is resulting in a loss of its functional properties.

\*\*\*\*\* - Fractal (Latin Fractus - crushed, broken, broken) - a geometric shape with the property of self-similarity, which is composed of several parts, each of which is similar to the whole figure entirely. Material is from Wikipedia.

### 13. Literature

1. L.Melnik. The methodology of development. - Sumy, University Book, 2005. 601 pg.

2. Philosophical Dictionary. M. Rosenthal, P. Yudin. 2nd ed. MA Political Literature. 1968. 632pg.

3. Encyclopedic Philosophy Dictionary. Chap. Editorial: L.Il'ichev, P.Fedoseyev, S.Kovalev, V. Panov. M. Owls. Encyclopedia, 1983. 840 pg.

4. L. Melnik. Economy and Information. Encyclopedic Dictionary. Sumy, University Book, 2005. 384pg.

5. D.Petrov. The systems approach to the study of biological objects. Proceedings of the II International Scientific and Technical Conference "Information-measuring diagnostic and control systems." Southwestern State University. Kursk., 2011. 348 pg.

6. E. Eskov. Ethology of honeybee. Moscow: Kolos, 1992, 334 pg.

7. N. Reimers. Popular Dictionary of Biology. M. Science, 1991, 536pg.

8. A. Zakharov. Ant, the family, the colony. Moscow: Nauka, 1978. 144 pg.

9. G. Wells. The new system of beekeeping with two queen bees in one hive. Trans. from English. Ed. V.Izergin, 4th ed. Petrograd. Ed. A. Devrient. , 1917. 32 pg.

10. B.Kazhinskiy. Biological radio. Kiev. The Academy of Sciences of the Ukrainian SSR. 1963, 167 pg.

11. The patent for invention number 91765 Microapiary of Petrov.Ukraine.2010.

12. V. Polischuk, V. Gaidar. Apiary, Kiev, PERFECT SWTYLE, 2008 267pg.