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Categoria C *ISSN 1857-3517*

EVOLUTION DOES NOT WIPE OUT ITS TRACES, BUT KEEPS THEM FUNCTIONAL

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Evoluţia este o realitate cosmică şi nu este caracteristică numai vitalului, ci întregii lumi materiale. Putem vorbi de evoluţia atomilor, a elementelor chimice, a cristalelor şi a vieţii, dar şi de evoluţia structurilor astrale (plante, sori, nove, constelaţii, comete, etc), a limbii, a maşinilor electronice de calcul şi altor categorii de sisteme. Ceea ce este important şi impresionează este faptul că toate etapele evolutive a fiinţelor vii, a atomilor, a elementelor chimice, cristalelor şi a structurilor galactice sunt păstrate în natură şi sunt funcţionale, nu sunt şterse. Nici o fază nu este eliminată ca fiind necorespunzătoare. În acest sens aducem dovezi evidente pentru fiecare palier evolutiv (atomi, elemente chimice, cristale, viaţă, cosmos). Evoluţia nu-şi şterge urmele, nu-şi înghite fiii asemenea lui Cronos; toate etapele evoluţiei sunt păstrate în natură fiind funcţionale. În această lucrare demostrăm că în natură funcţionează o lege generală tot atât de valabilă ca legea a II-a a termodinamicii: EVOLUŢIA NU-ŞI ŞTERGE URMELE, CI LE PĂSTREAZĂ FUNCŢIONALE.

Life has planted itself the roots deplz as far as in the subatomic structures, it selected the necesarz chemical elements, it learned the harmony, symetry and perfection from the crystals and it toak over from the three prebiological evolutive levels a multitude of information and patterns, making from evolution a global and unitary phenomenon. Biological evolution is not above the other evolutive levels and does not function independently. In what follows we will present the new fundamental low of evolution: THE EVOLUTION DOES NOT LOSE ITS TRACES, BUT KEEPS THEM FUNCTIONAL.

Keywords: prebiological evolution, biological, spiritual, fundamental laws

1. Introduction

The theory of evolution was launched by Jean Baptiste Lamarck, in 1809, as the theory of transformation, presented with arguments in his book titled Philosophie Zoologique. We could, however, consider that this theory was offered to the general public too early, without the public being ready for such a turning point in their thinking. The species transformation under the influence of the environmental conditions (both external and internal circumstances) is nothing but evolution.

The successful launching of the theory of evolution, an outstanding success when it emerged 50 years later, through Charles Darwin's theory, when his main book The Origin of Species (The Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life) was published.

The success was triumphant, worldwide, from the very first moment of its presentation by Ch. Darwin. We may consider this success to be preserved even nowadays, although multiple other theories emerged during the years (over 150 years) influenced by Lamarck, Darwin, Neo-Darwinist, anti-Darwinist etc. The Synthetic Theory of Evolution (STE) has been trying, by any means, to find other mechanisms of transformation of species than the ones conceived by Darwin.

The Theory of Evolution has been a breakthrough both for the biological and for the philosophical thinking and has triggered strong controversies, which couldn't find their place in the history of science, and some anti-evolutionists nowadays state, with an easiness that is hard to understand and to accept, that the evolution does not exist as a cosmic phenomenon and that the evolutionism should be eliminated from human thinking. Some of these people don't even know the difference between evolution and evolutionism. Nowadays, they are no longer searching for arguments to prove the theory of evolution as false, they proceed to the denigration of this conception through awful rejections, without any scientific arguments, by bringing other theories into discussion

or praising the scientific creationism. The important fact is that the Evolutions did not fall, as a country's government and will not fall either.

This kind of „experts", „scholars" is of no interest to us and we consider that the evolution is a cosmic reality, which characterizes not only the living world, but the whole material and spiritual world.

As an evolutionist by conviction and by profession (I used to teach the Evolutionism at the Faculty of Biology of the „Al. I. Cuza" University in Iaşi), not only I endorse the laws of evolution, but I want to bring to light a new law, which has not been formulated yet, but it is nonetheless as valid as the known laws of evolution and even as the two laws of Thermodynamics.

2. Biological evolution

The concept of evolution defines both the cosmos as well as the material and spiritual infinity, because any material system is dynamic, in a constant transformation or becoming of its features, in an endless flow (Panta Rhei), as Heraclitus considered. His disciple Cratylos surprised the perpetual flow of the systems in his aphorism "*you cannot bathe twice in the same river."*

If till to Charles Bonnet (1762) the term of evolution was used for the characterization of ontogenesis, he confers to evolution phylogenetic dimensions.

Darwin broadens the term of evolution conferring it the attribute of universality. He substantiates the hypothesis in conformity with which all the organisms underwent major transformations over the geologic time, which ensured biological progress on the one hand and, on the other hand, the survival of species.

Evolution is a cosmic reality and it is not characteristic only to the vital energy (living beings), but to the whole material world.

Some evidences are so obvious, that you can ask yourself why they are not seen and recognized by some of the so-called connoisseurs of the vital field, who attempt to reject the concept of evolution?

Let's follow the formation of the digestive tube in the group of Turbellaria in the phylum of Plathelminthes.

In the most primitive forms of Acoella it is not individualized a digestive tube. The organisms present an opening mouth, but the food enters directly into a digestive syncytial tissue associated with the body parenchyma, as it is in *Nemertoderma bathycola* (Fig. 1).

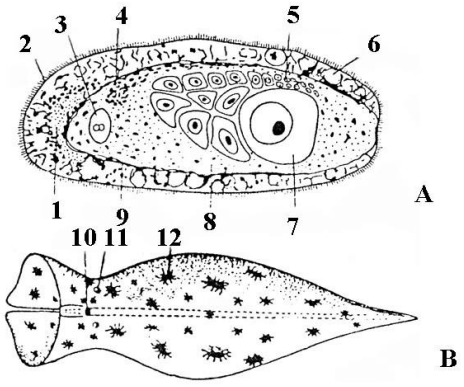

Fig. 1. A – *Nemertoderma bathycola*; B – *Convoluta hipparchia*: 1 – fore concentrations of neurons; 2 – epitelium; 3 – statocist; 4 – testis; 5 – ovary; 6 – tegumentary gland; 7 – ovule; 8 – parenchima; 9 – subtegumentary muscle layers; 10 – buccal orifice; 11 – eyes; 12 – pigmentary cells [16]

In **Rhabdocoella**, for the first time, it is individualized a digestive tube, which appears as a straight tube, closed at the bottom of a bag, hence the group name. The digestive tube extends in a straight line like a little rod (Fig. 2A and B).

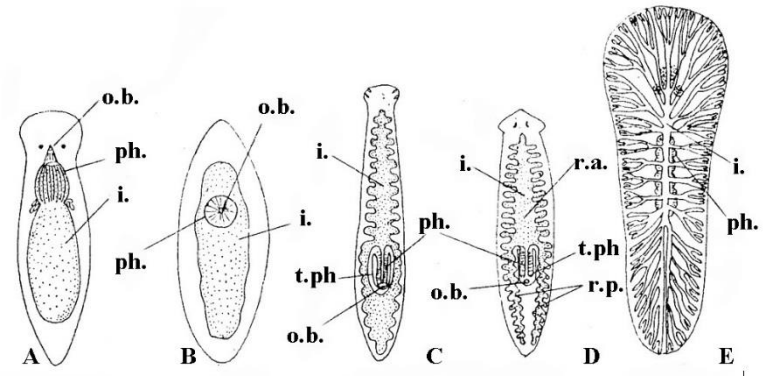

Fig. 2. The digestive system in Turbellaria: A and B in Rhabdocoella, C in Aloeocoella, D in Tricladida and E in Polycladidai – intestine; ph – pharynx; .b.0. – buccal orifice; t.ph. – pharyngeal pod
u.r. – upper ramus; r.a. – anterior ramus of the intestine
[Barnes A., 1968; Karling, B., Dörjes, Mack-Firă, Hyman, C-E., 1951]

In **Aloeocoella**, it is found an evolutive leap in terms of the structure of the digestive tube. The intestine has three branches: one in front of the body and two that focus to the posterior part. The posterior branches are merged to form a ring around the pharynx (peripharyngeal ring), as it is the case in *Bothrioplana semperi* (Fig. 2 C).

An evident progress is in the species of the order **Tricladida** whose digestive tube has three well individualized branches; a branch oriented to the anterior part and two to the posterior part. All branches have numerous lateral diverticula forming a pseudometamery. Among the diverticula of the digestive tube, there are found the testicular follicles, as it is the case in *Dugesia* (Fig. 2 D and Fig. 3 A).

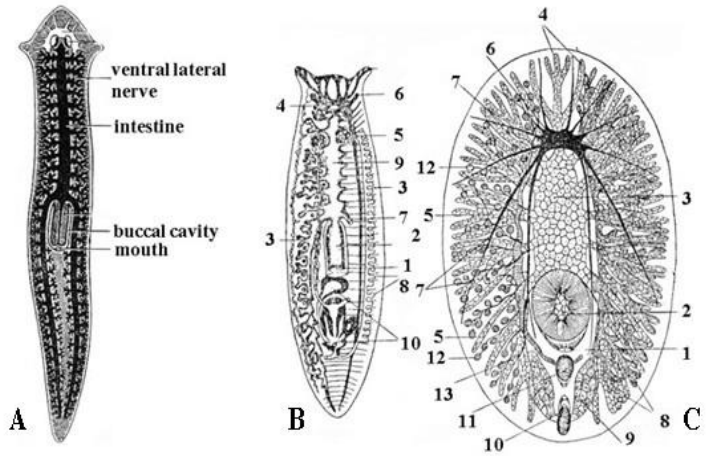

Fig. 3. A. Dugesia. The digestive apparatus and the nervous system [12];
B. C. Digestive tube of Triclade policlade.
B: *Procerodes lobata*:1 – mouth; 2 – pharynx; 3 – branches of the intestine; 4 – ganglioni cerebroizi; 5– eyes; 6 – tentacule; 7 – longitudinal nervous cord; 8 – vitelligenous glands; 9 – ovary; 10 – genital apparatus;
C: *Leptoplana tremellaris*: 1 – mouth; 2 – pharynx; 3 – central part of the intestine;
4 and 5 – Lateral branches of the intestine; 6 – cerebroid ganglia; 7 – radial nerve cords;
8 – parties of the ovary ; 9 – uterus, 10 – female genital orifice ;
11 – copulatory organ;12 – testes; 13 – spermiduct

In the order *Polycladida*, the intestine presents several branches, which are arranged more or less radial, as in *Leptoplana tremellaris* (Fig. 4 B).The development and the ramification of the digestive

tube can be perfectly correlated with the significant increase of the body mass in Turbelarians. The digestive tube takes over the function of circulation too, in the acoelomate animals. We can talk about the gradual constitution of gastrovascular apparatus.

What impresses and we must emphasize this, is the fact that all evolutive stages of the digestive tube are kept in a functional state in the present nature in different species. No phase has been eliminated as being inadequate, none is a waste of evolution. On the contrary, in every stage, the evolution is appropriate to the life way of these animals and especially their life claims in the environment in which they live, correlated with the body dimension.

Evolution does not wipe out its traces, evolution does not swallow its sons like Chronos; all the stages of evolution are kept in nature as being functional.

2.1. The evolution of aortic arches in the series of Vertebrates

The model of the arterial arches in fish is at the basis of all vertebrates, including humans. This aspect can be followed both in ontogenesis and in the final disposal of the aortic arches in adults (Fig. 4 and 5).

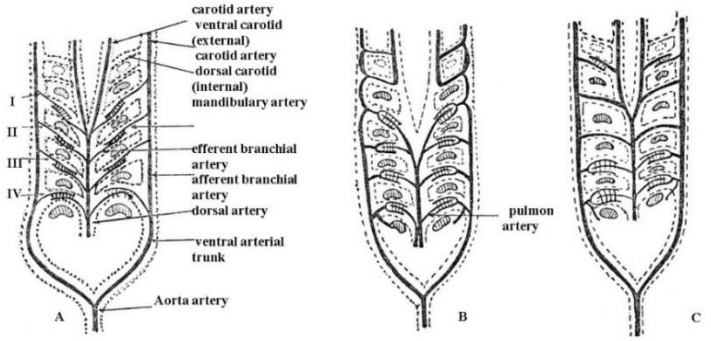

Fig. 4. Evoluion of arterial arches in fish: A – Arterial arches in Teleostei;
B – Arterial arches in Neoceratodus (Dipnoi) C – Arterial arches in Protopterus [4]

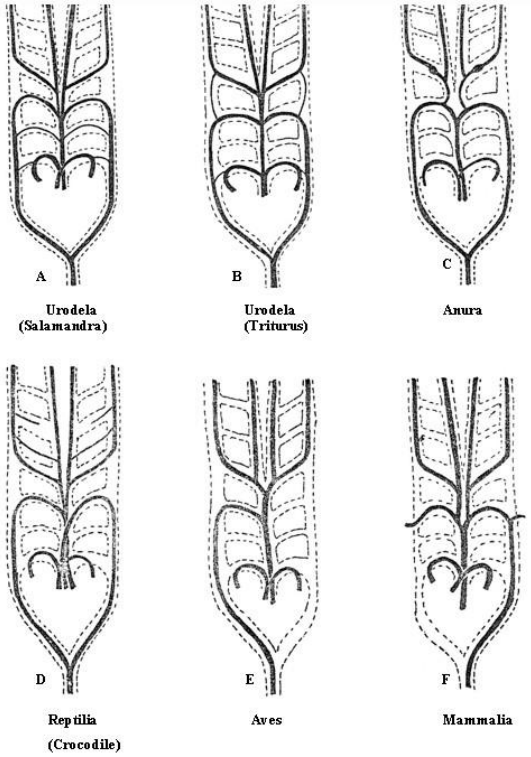

Fig. 5. Evolution of the arterial arches in Tetrapoda [4]

That the evolution of the arterial arches in Vertebrates is achieved according to a unique model is proved by the fact that in human too, in ontogenesis, it is respected the same model. More than that, even in humans, in some teratological cases, one can keep the communication between the two atria through the orifice of Botallo (reminding of the Botallo's channel from Reptiles), causing the so-called **blue disease,** due to the fact that a mixing of oxygenated blood with that deoxygenated takes place. Moreover, in teratological cases, one can maintain the communication between the ventricles through the Panizza's orifice.

The appeared modifications in the disposition of the arterial arches must be correlated, necessarily, with the correlative modifications appeared in the structure of the heart in each class of Vertebrates.

A question seems natural: if these morpho-functional transformations reached the functional optimum in Birds and Mammals, then, why are the transitional forms retained in nature? Why were all the stages in the evolution of arterial arches kept functional in nature? Starting from the primitive model of the aortic arches from Fish, we find the effectuated modifications stage by stage in their evolution up to Birds and Mammals. Each stage is kept as being functional even in the present stage of evolution. Some consider that all the structures situated below the evolutive stages of Birds and Mammals would be some wastes that should be removed from the existence of the present animals. Forcing the things, some of them would intervene and would achieve a genetic improvement of structures considered by them as being inadequate.

The reality is that for all these groups the structure of aortic arches is more or less perfectly appropriate to their claims to life (their way of living).

The scheme of evolution of the arterial archers in Fish seems to be archaic. We must recognize, however, that as in case of Fish, we find and obsolete phase, the transition from six pairs of arterial archers to four pairs. In Fish too, we feel that modification appeared in the structure of arterial archers depending on the appearance of the lungs. The Fish were overcome in the evolution by all other vertebrate groups. But can someone affirm that Fish are wastes of evolution, wastes of nature? Can you affirm that Fish do not feel well in their life environment? Can you not remain impressed by the performances of predators of the sharks? In the systematic hierarchy of the Fish, each group was at the top of evolution. In the same way, we must think in terms of Batrachians and Reptiles. Should nature keep in the present fauna of the Anthropogenic, only Birds and Mammals, the other ones being wastes of evolution?

2.2. Arthropoda the circulatory system

At Arthropoda the circulatory system is following the same pattern as in Annelids. The Annelids dorsal vessel is homologous to that from Annelids (Fig. 6).

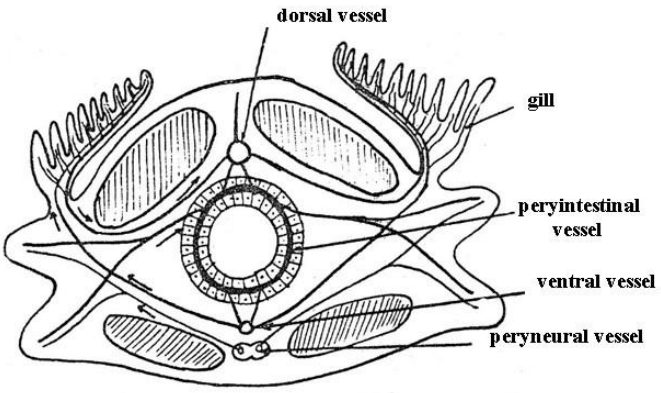

Fig. 6. The scheme of circulation
at the level of a segment of anelid [16]

In most primitive cases, in all the groups, the dorsal vessel stretches over the entire length of the body. The vessel network is particularly rich in *Limulus mollucanus*; just the capillary vessels miss . The heart is well developed and is located on the dorsal vessel (Fig. 7 A).

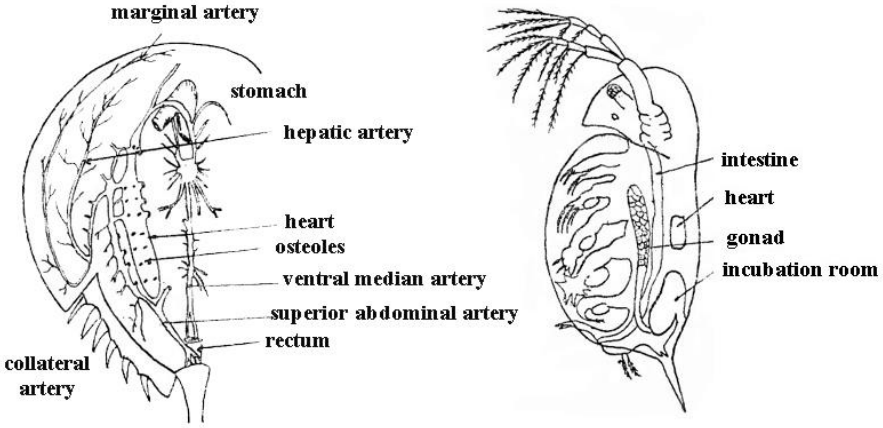

Fig. 7. A. Scheme of the circulatory apparatus in Limulus [5];
B. The circulatory apparatus in Daphnia [16]

A similar situation is encountered too in Scorpions, in Stomatopoda among Crustaceans, in Chilopoda and Diplopoda among Mirriapoda and even in Blattoptera among Insects. The primitive forms of Arthropoda have large dimensions, some of them being just huge and the network of vessels very complex. We can find two very interesting aspects in the evolution of Arthropoda:

- reduction to the disappearance of the circulatory apparatus
- correlative decrease of the body size reaching down to microscopic forms.

Out of the whole circulatory apparatus only the heart remains in some Cladocerans (Fig. 7) and Gamasids among Crustaceans, or any trace of the circulatory apparatus disappears as in some Copepods and Ostracods among Crustaceans and many species of mites (Acarina, Chelicerata).

Is this a regressive evolution, an involution? Certainly not. In the series of Arthropods we can surprise a spectacular evolution of the nervous system, which starts from a nervous system of scalariform type in the primitive forms, similar to that of annelids, with which it presents evident phylogenetic affinities.

What is very important in our understanding is that in all the groups of Arthropods, in the present fauna, there are kept all the stages that prove the reduction to disappearance of the circulatory apparatus. From *Limulus mollucanus* of Xifozures to *Sarcoptes scabiae* or *Acarus siro*, among mites, we meet all the stages of simplification of the circulatory apparatus to the disappearance and reduction of the body size to refusal.

2.3. Colonial integration

But, we notice a spectacular evolutive leap in the transition from the solitary individuals to colony within the chlorophyceae algae.

It seems accredited the hypothesis that the transition from the unicellular organisms to those pluricellular ones was realised by the colonial forms. Surely, the association of cells and the formation of some colony present important adaptative and evolutive advantages. If it was not so, then we could not explain the existence of simple colonies, with a small number of cells.

If *Chlamydomonas angulata* is a solitary unicellular species (Fig. 8), *Pleurococcus vulgaris* forms a colony only of two cells. Cells are perfectly identical and are connected by plasmodesmata. If the cells are separated and live independently they can rebuild their colony.

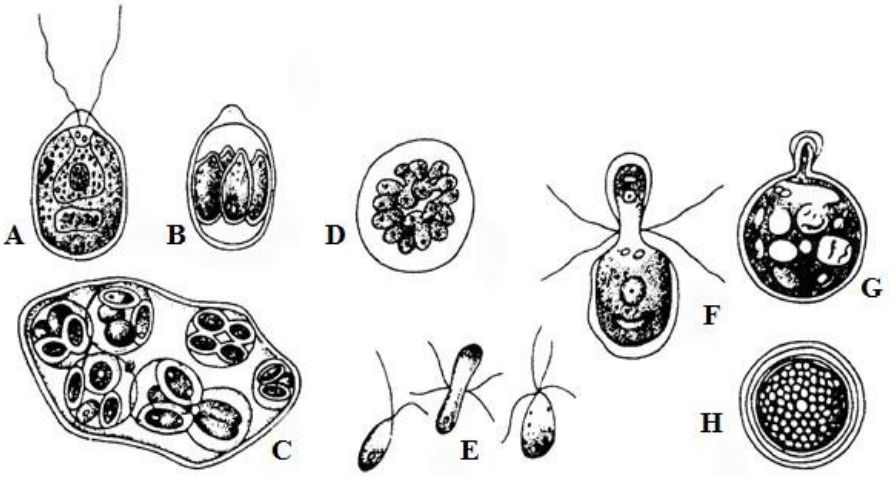

Fig. 8. *Chlamidomonas angulata*: A – vegetative state; B – asexual propagation stage; formation of 4 new cells; C – palmelar stage; D – formation of gametes; E – isogametes and their isogamia; F – close merger heterogametes; G – oogamia; H – zygote [3]

Colonies are gradually complicating : 4 cells at *Gonium sociale*, 8 cells at *Pandorina morum*, 16 cells at *Gonium pectorale*, 32 cells at *Eudorina elegans* etc (Fig. 9).

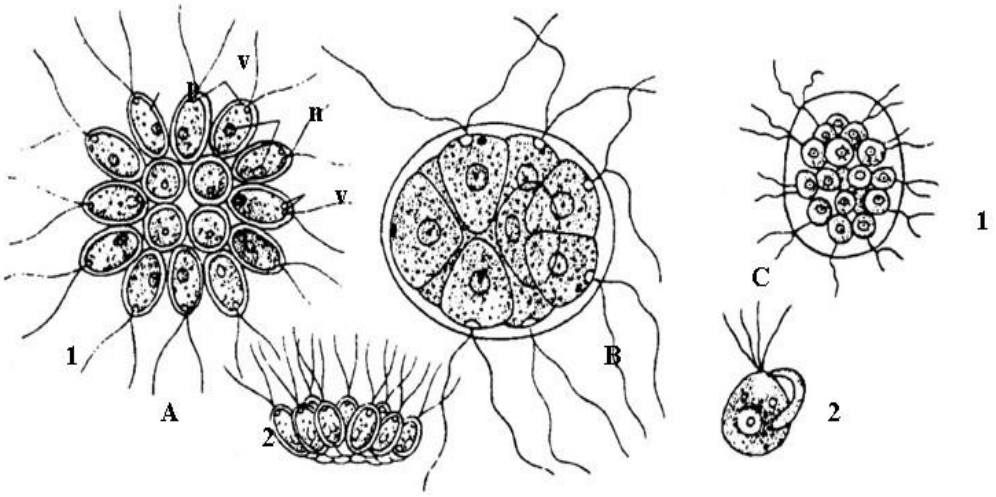

Fig. 9. A – Gonium pectorale, colony seen by above (1)and lateral (2); p – protoplasma; n – nucleus; v – vacuoles; B – Pandorina morum, a colony of 16 cells; C – Eudorina, (1) adjacent (2) gametes in copulation [3]

At *Volvox globator* the colonyes reach 16000 cells (Fig. 10). The fact that the cells associate to live together, it means that they prefer this thing that it is a reaction of attraction, of partnership, not one of rejection. When the number of cells is very small, each keeps its structural and functional peculiarities. The whole wins, however, something. If the number of cells in the colony is higher, there starts to appear some morpho-functional differentiations and then even behavioural. In the colony formed of 16 cells, a morphological shaft differentiates, which means the first more important step on the way of colonial integration – the orientation of colony. Though the cells can live isolated, in this case too, it is manifested, however, a constant structure of the colony. The different position of cells within the colony causes the appearance of some morpho-functional modifications. These are accentuated together with the increase of colonial integration.

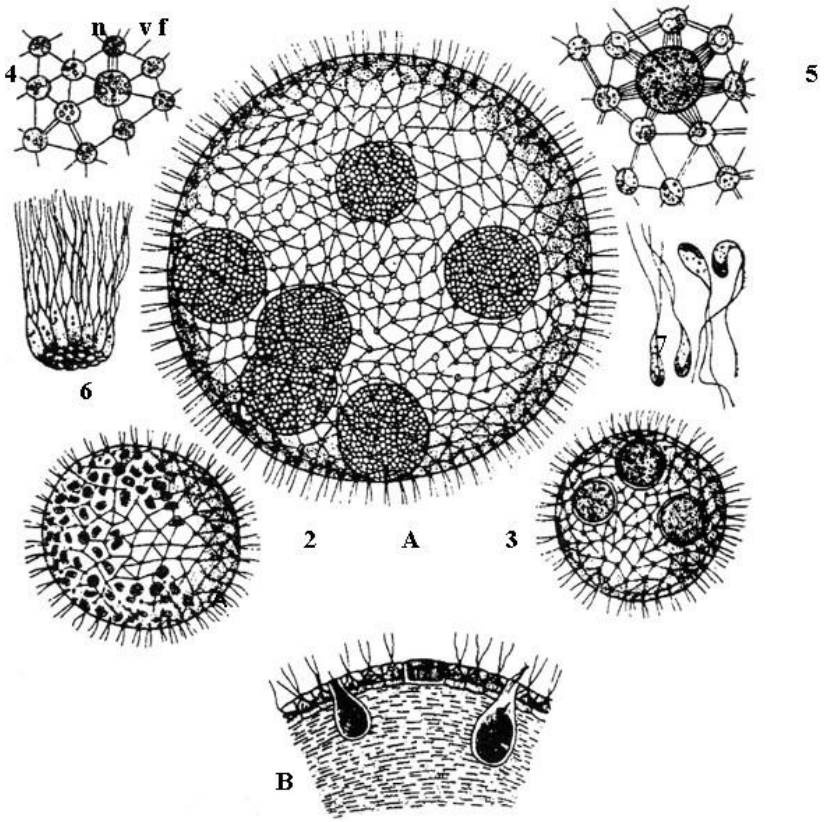

Fig. 10. A. *Volvox aureus*: 1 – colony fully developed with six other colonies appeared on the vegetative path; 2 – colony with antherozoids ; 3 – colony with 3 oospheres; 4 – a part from a colony with spermatogenous cell (anteridial); 5 – idem, with a oogonial cell (oophere); 6 – form of antherozoids; 7 – free antherozoids; B. *Volvox globator*: a sector in colony [3]

At *Volvox globator,* the colony behaves like a pluricellular individual. Cells depend in their existence on each other; they lose some features, while the whole wins other ones that offer much higher ecological and evolutive advantages.

A question persists in our mind: how some colonies formed millions of years ago, on the aggregation path, remained at the level of 2, 4, 8 or 16 cells, even if it is a game of the number of cells? If the colonial form offers an advantage, why did not they evolve to larger colonies?

As we realize, every step in the building of colonies has been kept, it was frozen. It is as if in each stage the respective form is sufficient for it. It does not need more. A superior stage already means something else. Nothing is lost from that it was created. Some species have the value like the exhibits in the Museum of wax figurines, as if they wanted to mark our path that started in the strategy of building of large colonies and in the appearance of the pluricellular organisms. The existence of each step in the building of the colonial forms in the present living world, proves us the fact that evolution does not wipe out the traces, but keeps them functional in each attempt. We believe it is wrong to use the term of attempt. There are not attempts in the evolution of living world, but different variants, of which some, the most successful and efficient, open the path of the morpho-functional progress and of the biological progress.

Analyzing the aspects for discussion, a fundamental discovery is revealed to us – in nature it functions a general biological law that has not been discovered till now, or rather it was not formulated precisely, namely: evolution does not wipe out its traces, but keeps them functional.

3. The evolution of chemical elements

It is amazing to analyze the periodic system of elements and to do the necessary correlations with the material world. When I was a high school student and learnt chemistry, some elements from the periodic table of elements were missing; they were not yet known, but they had their boxes, with all the chemical and physical characteristics. I did not know about the so-called **The Big chain of beings**, which sanctions the principle of continuity in nature, surprised by Aristotle.

The periodic system of elements is nothing else but a **Big chain of chemical elements,** which goes from stage to stage, without any empty space, or box (in the situation in which free boxes appear, it means that the respective elements have not yet been discovered, being hypothetical, but they have a real existence in nature). Here we discover the function, at an ideal mode, of the **principle of continuity**. This principle leads easily to the idea of evolution.

In this Big chain of chemical elements we can start from hydrogen, which is the first and most simple chemical element, in order to reach the last known or unknown element for the time being.

Even if hydrogen has one proton in the atomic nucleus, one electron and one electronic layer, it achieves a whole, which is perfectly functional, being well defined through its physical and chemical characteristics (structural and functional).

In the moment in which the atomic nucleus increases with one proton and the electron layer has two electrons, it is already about another element (helium), which has completely different physic-chemical characteristics.

The number of protons represents the **atomic number** that is the number of order of the elements in the periodic system structure. The atomic number determines the exact position of each chemical element in the periodic system of elements and, thus, in the Big chain of the chemical elements.

If a proton is added to the atomic nucleus and another electron to the electron layer, then the first layer of electrons being complete, a new orbital is formed. The element with three electrons in the atom is lithium, which differs both from hydrogen and helium.

The number of protons and electrons continue to grow in the periodic system of chemical elements to fully occupy a new orbital, forming beryllium, boron, carbon, oxygen and neon, which will have a number of 8 electrons on the second layer.

In the Big chain of chemical elements the difference from one element to another is given by the electron, which is added to the previous element: due to this fact this electron is called **distinctive.**

It is paradoxical the fact that the chemists have used the principle of continuity in the **Big chain of the chemical elements**, but they have gone further and have not mastered the principle of the evolution of chemical elements.

It is clear to everyone that the chemical elements are not spread in space or on the Earth uniformly in the same way it happens with the living beings. With regard to the living beings, we talk about **biodiversity.** It is natural to ask ourselves why the chemists, geologists and mineralogists do not speak about a diversity of the chemical elements in nature, about a **chemodiversity**? It is necessary to talk about the diversity of chemical elements in nature.

Another nodal problem that should be solved by chemists; if the chemical elements known so far can be considered as **chemical species,** with a well-defined status, we must accept that the chemical elements that present a series of isotopes have, in fact, several subspecies.

Such as in biology, in chemistry it should be spoken about the geographical distribution of the chemical elements.

To think that an atom of a chemical element that would be exceeded by the atom of another chemical element, with a higher number of order, would become a kind of waste of nature, it would be an aberration. It is exactly what I was talking in the case of beings: Nature does not make rejects. The mechanisms of performance achieved by man do not become rejects if some parameters are

surpassed by other machines. It is said in this case that they have **moral obsolescence.** Such a term should not be used in biology or chemistry or astronomy.

Evolution does not wipe out any traces in this situation.

If the chemical elements known so far and listed in the periodic table of the chemical elements can be considered as chemical species with a well-defined status, we must also take into account the fact that some chemical elements present **isotopes;** they can be considered subspecies.

Isotopes have in their nuclei the same number of protons and electrons, but they differ in the number of neutrons. It is about elements with the same **atomic** number (Z), but with different mass number (A).

In case of chemical elements too, we can speak about an evolution because it takes place a gradual complication of those ones; it is passed through certain stages (links) that differ a little one from another in their linear succession, but there appear differences, differences that increase when the distance between them also increases. We would not speak about the big chain of the chemical elements if there missed some links. The essence of this concept is based on t**he principle of continuity,** of the continuous progress.

We must understand that an extremely important law works in nature, that the evolution **does not wipe out the traces, but keep them functional.**

4. The evolution of micro- and macrocosm

In order to be able to follow the evolution of the macrocosm it was necessary to start from the Big Bang. Steven Weinberg realizes an algorithm of the Big Bang and continues with the evolution of the universe until the final time imagining different eras and epochs on the spiral of evolution of the microcosm and macrocosm.

What seems paradoxical is the fact that we cannot follow the evolution of the Universe or of the Cosmos without following the evolution of the micro-cosmos, too, that is of the atom.

Things are so natural connected that you cannot separate them.

The Cosmos had an evolution that cannot be denied and which, at large, began to be deciphered by the human mind.

As we have presented before, the “seed” of the Universe or of the Cosmos does not contain but condensed information; there were neither elementary particles, atoms or molecules, there was nothing of material nature.

From this "nothing" under the form of substance, but rich in information and energy, after The Big Explosion (Big Bang) began the simultaneously building of the microuniverse and macrouniverse (Fig. 11):

After 10^{-45}! seconds It started the material existence, time and space:

- The Quarks were combined and formed protons and neutrons;
- The Protons and neutrons were united and formed atomic nuclei;
- The atomic nuclei gained electrons and formed atoms;
- The atoms were associated and formed molecules;
- The molecules were assembled and formed macromolecules;
- The organic macromolecules were assembled and formed cells;
- The Cells were associated, were differentiated morphofunctional and gave rise to living organisms, to unicellular beings, colonial and multicellular (Monera, Protista, Fungi, Plantae and Animalia);
- *Homo sapiens* occurred too and an anthropological evolution took place too.

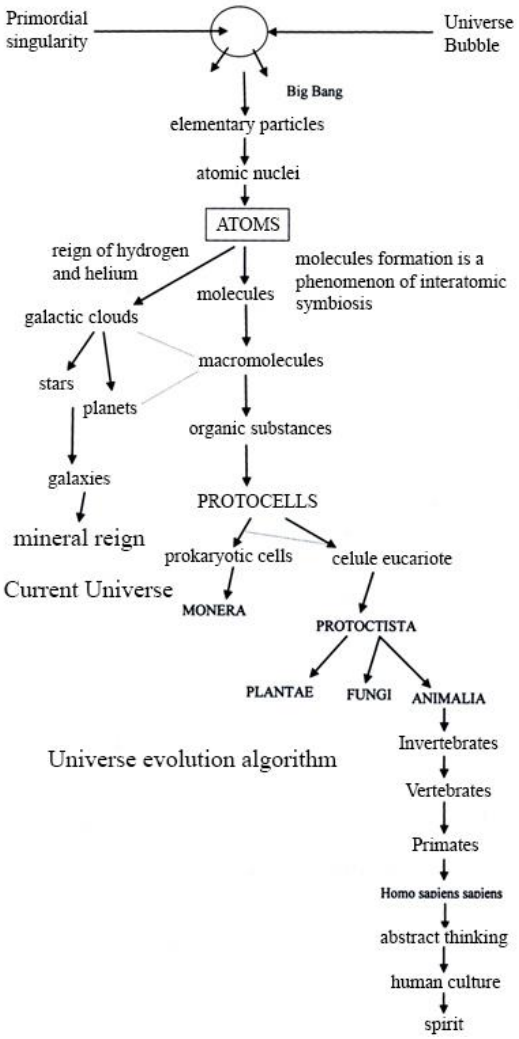

Fig. 11. The Universe evolution

5. Evolution in the world of crystals

Following the world of crystals it is impossible not to discover their evolution. As I said, it starts from simple, archetypal forms, which associated and form complex crystals. As a biologist, I see some complex crystals as some colonies from the vegetal or animal world, in which the cells still keep their individuality. In the more evolved crystals the individuals begin to form a common body, the whole having priority, similar to multicellular organisms. The most developed complex crystals seem to be a single crystal, but they betray their complexity through the disposition of facets and through cleavage.

The crystals belong to the inanimate world, a stone-still world. We do not think that they give us the beauty of the earth, in its bowels that they have a potential energy that can resonate with the biological energy. Some crystals are used successfully in the treatment of some diseases; it is not about myths. Let's not forget that in the nucleic acids too crystallize and that they represent the propeller of life that twisting itself in spiral, it generated the spiral of biological evolution.

Life has planted itself the roots deeply as far as in the subatomic structures, it selected the necessary chemical elements, it learned the harmony, symmetry and perfection from the crystals and it took over from the three prebiological evolutive levels a multitude of information and patterns, making from evolution a global and unitary phenomenon.

Biological evolution is not above the other evolutive levels and does not function independently.

In the following we will try to demonstrate that between evolutive levels there is a multitude of interactions that make from evolution a global and real phenomenon. Who has knowledge must understand!

Evolution does not wipe out its traces neither on horizontal (on levels) nor on vertica

Some species of crystals represent true patterns (patents of nature) which are taken over on different levels of evolution. Lima de Faria demonstrates us by certain examples how a pattern from the world of minerals, of crystals, is taken over on other levels, namely in the world of plants and animals (Fig. 12, 13).

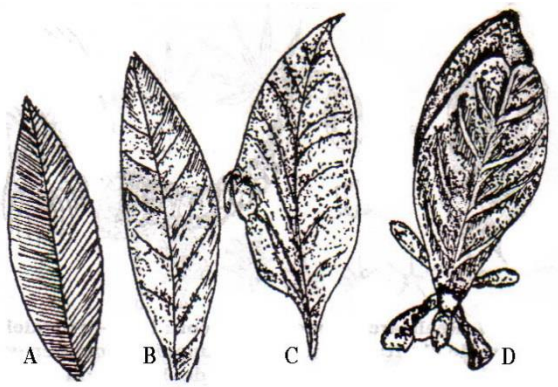

Fig. 12. Patterns taken over on different levels: A. bismuth crystal ; B. leaf; C. Kalima imachis; D. Chitoniscus feedjeanus [6]

In the native state the bismuth crystal (Fig. 12 A, 13 A) has the aspect of a simple leaf. This model (pattern) seems to be taken over by leaves from the plants, but also by the wings of the butterfly *Kallima imachis* (Fig. 12 C, 13 B), and even by the wings of the phasmid *Chitonicus feedgeanus* (Fig. 12 D, 13 C).

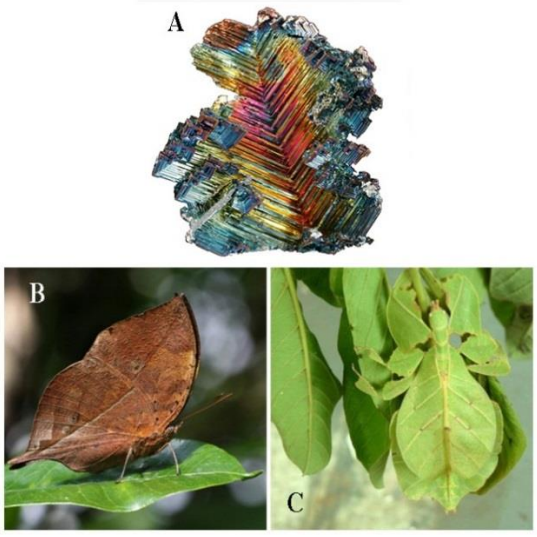

Fig. 13. A. Bismuth crystal; B. *Kallima imachis*; C. *Chitonicus feedgeanus*

The symmetry and the form of some crystals that charm you by form and harmony are taken over in the symmetry and the form of some viruses (Fig. 14 B) which will become more dangerous, of some of foraminifera and Radiolaria, of numerous pollen grains from plants (Fig. 14 E) and even in some fruits.

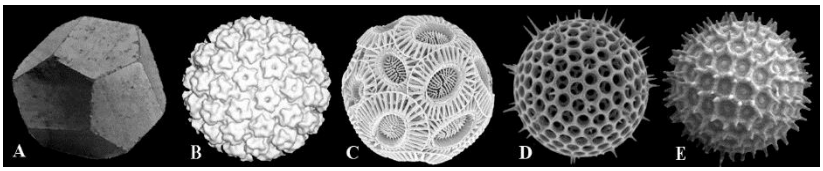

Fig. 14. A. crystal of pirytes; B. Human papilloma virus; C. Emiliania huxley – Cocolitofor; D. Radiolarian; E. Pollen (http://www.mathcurve.com/polyedres/geode/geode.shtml http://pubs.rsc.org/en/content/articlelanding/2011/ce/c0ce00679c#!divAbstract)

Are all these striking similarities simple or simple accidents of nature? Was nature forced to discover the "wheel" at the level of each evolutionary level or a patent well done and "verified" functional is taken over on other evolutive levels?

Nature is intelligently structured and a patent once achieved can be used whenever is needed.

As a model of building of some complex crystals, the spiral is met in multiple classes of crystals. But, spiral, either logarithmic or Aristotelian abounds in nature.

Rightly, Mario Livio [7] states that: "Nature loves logarithmic spirals. From the sunflower, marine shells and eddies, to hurricanes and giant spiral galaxies, it would seem that it has chosen this miraculous form as favourite "ornament" (Fig. 15).

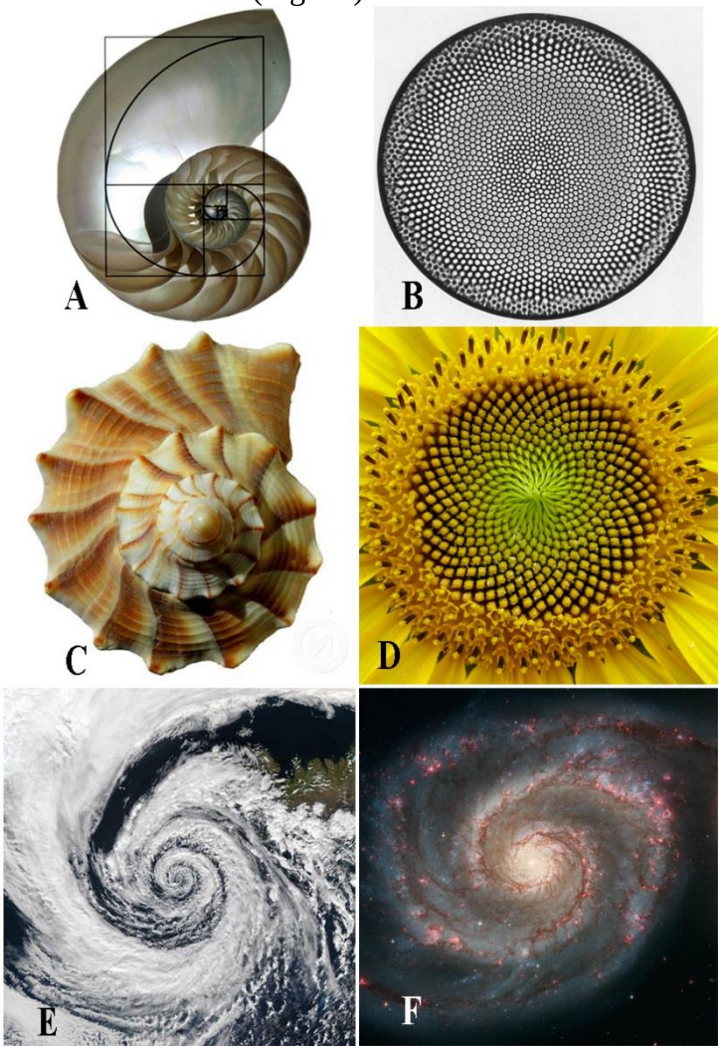

Fig. 15. A. Nautilus shell; B. Coscinodiscus radiatus; C. Marine snail shell; D.Sun flower; E. Storm; F. Wirlpool Galaxy

The spiral represents the ideal model in the world of crystals, of viruses, of shells of Foraminifera (Fig. 16 A), Radiolaria and molluscs (Fig. 16 B), in the world of plants (Fig. 16 C), in the flight of peregrine falcons (Fig. 16 D) and in the fantastic existence of galaxies.

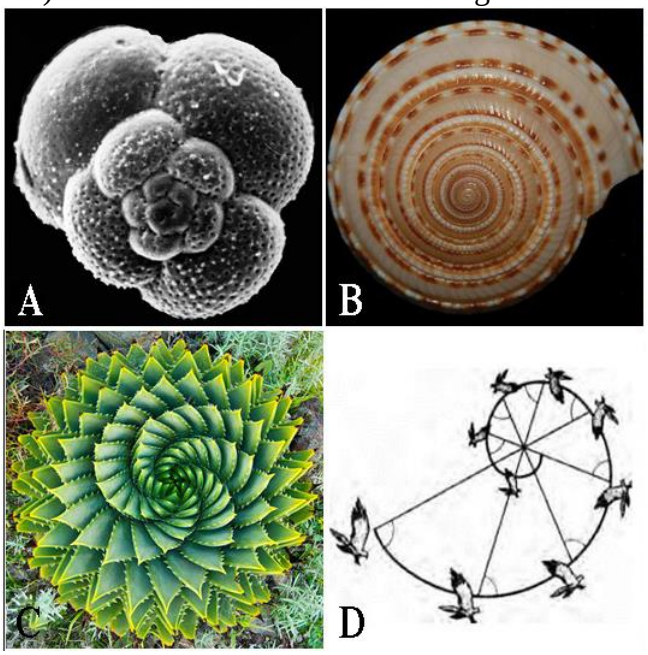

Fig. 16. A. Foraminifer; B. Marine snail shell; C. Aloe sp.;
D. The trajectory of the flight of the peregrine falcon

Nature cannot be overcome regarding the beauty, harmony and exactness. Watch the movement of gyroids and the building of complex crystals. Before returning from your emotions, gaze and follow with how much precision a climbing stem twists around a support (Fig. 17 A), how it seeks the leaves of a branch, or the branches of a twig, the most optimal positions to receive light, air, and moisture without being embarrassed by the others. (Fig. 17. B, C, D).

Fig. 17. A. B. C. D. Examples of phyllotaxy in the vegetal kingdom

Posing for discussion the evolution of the microcosm and macrocosm we have discovered that it starts from the same root and the unique beginning. Thinking in the same way, we realize that we cannot separate trenchantly the atomic universe from that chemical one (when we speak of atoms we must specify the atoms of the chemical elements we speak about). Similarly, we cannot separate trenchantly the universe of the chemical elements from that of crystals one (or the mineral universe).

If we cannot separate perfectly those three prebiotic evolutionary levels and find a series of common elements that make unity between them, we find out that in this way we cannot separate categorically the prebiotic evolutive levels from those biological ones. If we take and examine a diamond it means that we accumulate valuable data regarding the carbon as pure chemical element, atoms of carbon and carbon crystal.

Although viruses are not accepted as living beings due to the inability of self-reproduction we should not be blind and not to see and understand that they have in place all the mechanisms through which to oblige the hosts to reproduce them. If the presence of the nucleic acids as genetic material in the structure of viruses does not seem convincing for some virologists to confer them the status of living beings we cannot put into discussion the fact that in the symmetry of some viruses we find take overs from the symmetry of some crystals (Fig. 18)

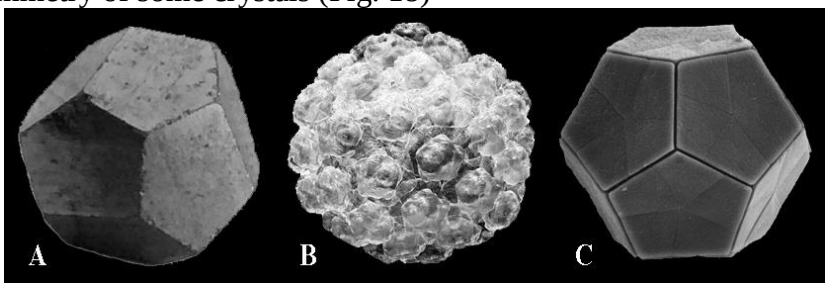

Fig. 18. A. Pyrite crystal; B. Virus, C. Diatoms

We could consider that it would be simple coincidences; however, the fact that such models are abundant in the living world (Foraminifera, Radiolaria, Coccolithophoridae, Diatoms, etc.) (Fig. 19) demonstrates us that some patents of nature are used as such on different evolutionary levels.

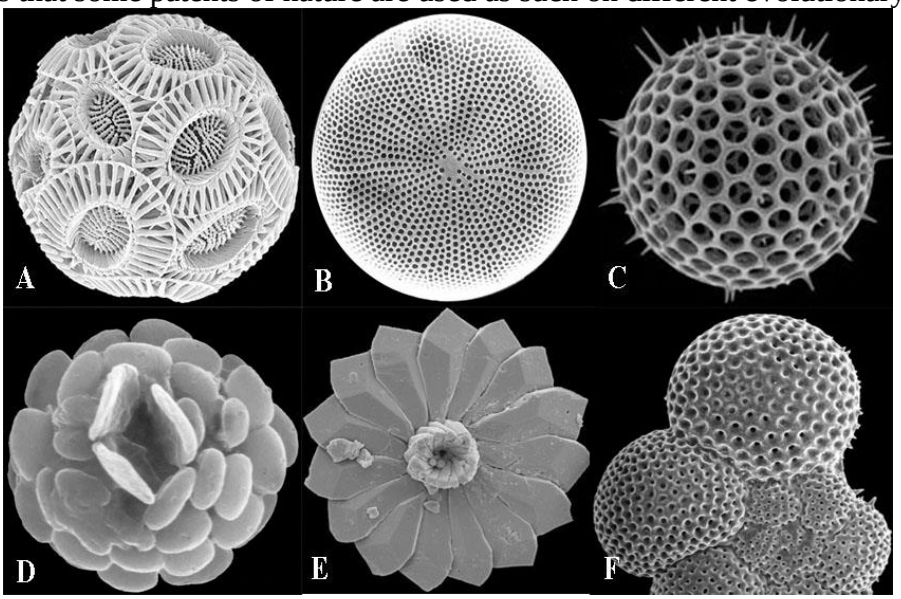

Fig. 19. A. *Emiliania huxleyi*; B. *Coscinodiscus radiatus*; C. Radiolaria; D. *Algirosphaera robusta*; E. Fossil Discoaster; F. *Globoquadrina hexagona* [Young, J.R., Bown P.R., Lees J.A., http://ina.tmsoc.org/]

We want to demonstrate that it is not about coincidences, but of taking over of some patterns (biological patents) from one evolutive level to another.

The world of crystals seems to be a stone-still world forever. It is just because we do not see their genesis; we do not see the association of basic units, their spatial display, the twisting of symmetry axes and the translational movements that make possible the emergence of complex crystals. In some magmatic rocks we can observe with the eye of mind the unimaginable dynamics of magma. We can surprise the nascent crystals or in all their glory. Numerous geodes that are formed present a myriad of crystals, from the smallest to the largest ones (Fig. 20). Watching carefully these crystals we can surprise a true Darwinian struggle for existence and for the conquest of verticality.

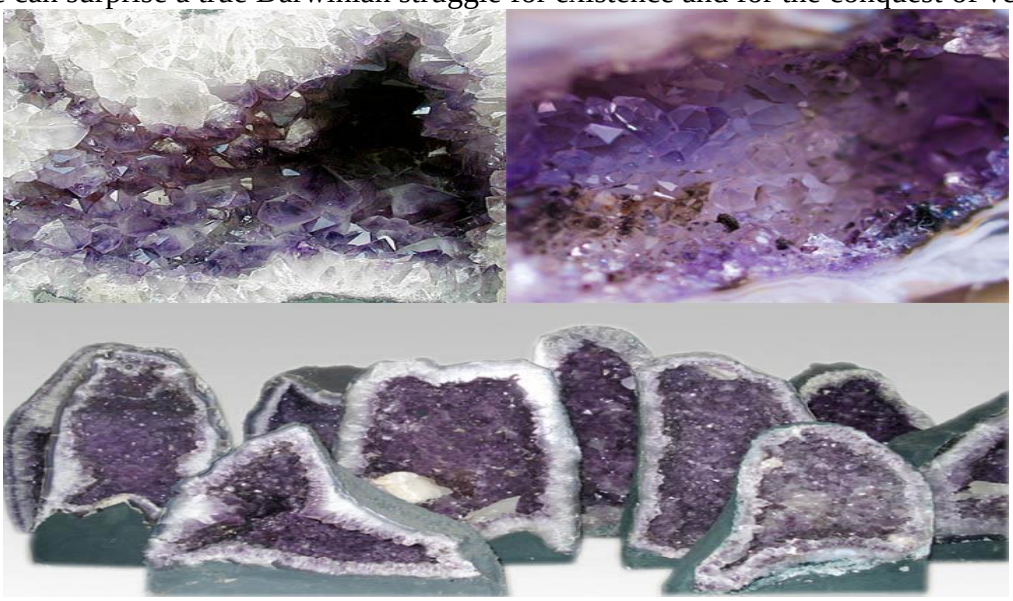

Fig. 20. Geode

It is sufficient to follow the display of the seeds in a **sunflower** chapter, in a rosette of achenes of a **dandelion** and the ornaments on the outer wall of the algae – ***Coscinodiscus oculus iridis***, of diatoms (Fig. 21) to understand what a patent of nature means and its taking over on different evolutionary levels.

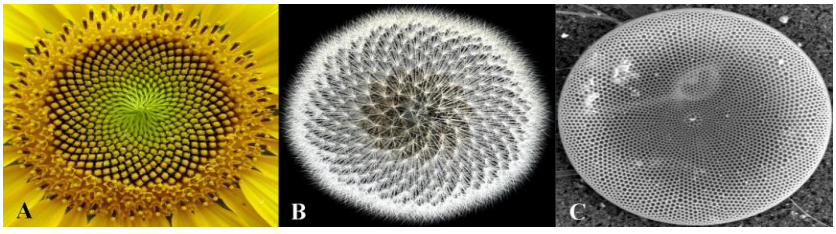

Fig. 21. A. Sun flower; B. Dandelion; C. *Coscinodiscus oculus-iridis*

I also stated and strengthen our affirmations that crystals represent the apogee of evolution in the inanimate world. We think of complex crystals and quasi-crystals.

Understanding the universe of crystals you immediately realize that you meet together simple and complex crystals (compound). Doing some order for their understanding you realize that you assist to a real evolution of crystals; in each class of crystallization it is started from simple forms to more and more complex ones.

The simple crystals are those primary or archetypal that can be easily recognized. By associating several simple crystals, of the same or different kind, composed, polyhedral crystals are

formed. Their complexity depends on the proportion and the number of simple forms that come in combination.

The crystals on the Terra were formed in the ontogenesis and phylogenesis of this planet; those which are found in some meteorites might have certain particular characteristics.

We speak about the ontogenesis and its phylogenesis because it is not just about its birth but also the huge transformations it has undergone over billions of years.

We must also take into account that Terra is not a dead planet. Both in its bowls and its entire structure the planet is full of life, it is in a continuous transformation initiating life and being much influenced by the vital phenomenon.

As in caves, stalactites and stalagmites grow hour by hour, year by year and pass the geological eras constituting a proof of the past time, so in the earth's mantle and boiling magma of the volcanoes there is a permanent transformation of crystals, a real evolution

It seems as heresy to speak about the evolution of crystals, but the eyes of mind and mirror neurons stimulate us to feel the world as far as its limbs, as far as the deep structures of matter.

The transformation of a hexahedron (cube) in a rhomboidal dodecahedron and of this in a deltoidal icositetrahedron can mean the transformation of a crystalline entity into another, consequently, evolution.

If the crystallization systems would represent the phylums of the CRYSTALES kingdom and the crystallographic classes would be classes, or even orders, then, it could outline some phylogenetic trees through which to demonstrate the transformation of some crystalline species in others.

Thus, in the cubic system (cubic phylum) it starts from the archetypal form of a cube, which has six equal square faces (hexahedron). By adding 4 digyres (rotations) in the direction of the diagonal of the cube, there are obtained those 5 classes of the cubic system; the axial cross of the cubic system is given by three axes of equal size, enclosing an angle of 90° C (Imreh, 1966, p. 84).

Starting from the hexahedron, with six equal square faces, one can get the rhomboidal dodecahedron with 12 faces and hence one can form a crystal with 24 triangular faces – tetrakis hexahedron. We find out a spectacular evolution in the transition from an octahedron with eight triangular faces to tetrakis hexahedron with 24 triangular faces. We surprise in these cases an impressive increase of complexity of crystals; it is what we call evolutive progress.

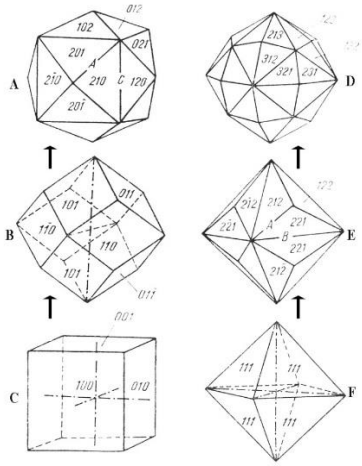

Fig. 22. Evolutive directions of some crystals in the cubic system:
A. Tetrakis hexahedron; B. Rhomboidal dodecahedron; C. Hexahedron;
D. Hexakis octahedron; E. Triakis octahedron; F. octahedron (according to Imreh, 1966)

It would be no surprise or anomaly to find out that an anomaly or a polyhedral complex crystal might derive from a more complex crystal by simplifying its structure. Moreover, Stoicovici, 1974 [13] is of opinion that the crystal of pentagonal dodecahedron type would derive from a more complex crystal – tetrakis hexahedron through alternative development and elimination of some of its faces [13, p. 106].

We can outline such phylogenetic trees in all the crystallographic systems and in every class (Fig. 22). All the forms are found in nature; evolution does not wipe out its traces, but keeps them functional. It remains only for us to discover them, to understand them and to put them in their place; It is about crystals in the big chain of crystals, if such a chain could be imagined some time.

Conclusions

Following the evolution as a cosmic phenomenon, we find out that it is characteristic both for the microcosm and for the macrocosm (what is natural because these formations start from the same root) and that they generate both the material world and the spiritual one.

No matter the level at which the evolution works, this ensures the **general progress**. The progress realized on the spiral of evolution does not cancel either of the earned accumulations in the successive stages through which it passed; nature does not create rejects and does not wipe out its traces.

In nature, the whole forms a fundamental unit, everything depends on everything. A genealogical tree (phylogenetic) cannot be considered but in its structural and functional totality, as the living tree could not function but in its integrity. Flowers, fruits and seeds could not exist without the structural and functional continuity of the whole plant.

If the evolution is a cosmic reality, then the law according to which the evolution does not lose its traces, but it keeps them functional, is a universal law too.

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THE ORIGIN AND THE SUCCESSION OF THE ECOLOGICAL PARADIGMS

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Sunt identificate și analizate paradigmele (viziunile dominante) naturaliste, evoluția cărora a condus logic până la cea actuală – privind organizarea și funcționarea ei sistemică. Bineînțeles, că la începuturi cunoștințele despre natură, de acum 2500 de ani, erau mult prea sumare, naive și chiar eronate, ca să nu zicem elementar greșite.

Noi folosim noțiunea de paradigmă într-un fel convențional, deoarece în zorile gândirii filozofice un mod dominant (paradigmatic) de abordare înca nu exista; cunoștințele gândirii empirice despre natura (mediul înconjurător) se transmiteau din generație în generație, conform legilor memeticii.

După Haeckel, ecologia a trecut prin trei paradigme succesive: autoecologică – populațională – ecosistemică (actuală). Astăzi, paradigma (eco)sistemică a devenit baza teoretică a environmentologiei – științei mediului (protecției și utilizării raționale a resurselor naturale) și, implicit, a concepției ecodezvoltării (dezvoltării durabile).

The first ecological paradigms (dominant visions) are identified and analysed. Their evolution logically came close to the modern approach dealing with the organization and functioning of the natural (ecologic) systems. It is obviouse that from the very beginning, the knowledge, as far as 2500 years age, were just factsand accomplishments compendiously and summarily collected, naive, artless and even erroneous, sometimes rudimentally mistaken.

In a way, we are using the notion of paradigm conventionally, because the philosophical thinking as a dominant approach did not exist about that time: the empirical knowledge about the environment were conveyed through generations according to the *memetics laws*.

The philosophy and science appeared simultaneously, as it was mentioned above, back with 2500 years, in ancient Greece due to the founder Thales from Milet (625-546 B.C.), affirming that everything around us is made up of water, while the other Miletian scientist – Anaximandros, (610-546 B.C.) carried out the first map of the Earth, as naive and primitive, an imaginary one, as one could concept. His fellow countryman Anaximenes (528-525 B.C.) produced the greatest "discovery", although it was also imaginary it read: all the world represents an entire organism, which breathes air. Hence, the first imagination of the biosphere in modern understanding came out.

The other two Greek thinkers made their appearance: Heraclit from Efes (540-475 B.C.) and Empedocle from Acragas, Sicily (490-430 B.C.). The former one considered fire as the basis of all things happening around, the latter considered that all four elements, the perennial ones as water, the earth, air and fire to be the essential elements (about all these element Empedocle wrote in his poem About nature").

The great number of outstanding Greeks is crowned by Platon from the Athens (427-347 B.C.), the father of the idealistic philosophy and of the concept about the system, as well as Aristotel from Stagira (384-322 B.C.) the pupil of Platon, a brilliant philosopher and the founder of the sciences of nature (as wellas of biosphere… biosphere with ecological connotation).

Since the beginning of sciences, the environment was considered by the ancient Greeks, the thinkers and philosophers (in a positivist manner) as something eternal, everlasting. Thus, the first Helenie naturalist paradigm stood out, a paradigm of ancient materialism undertaken leater on by the ancient Romans (for example, by Titus Lurcetius Carus and by Publius OvidiusNaso).

The theological dogmatism of the Middle Ages (that dominated approximalely 1000 years) left tooting positive landmarks in the history of the sciences of nature. However, mankind's thinking didn't cease.

The Renaissance – the wake up of man's interest about the ancient period – history, culture, philosophy, science and particulaly, aboutthe man, etc fallowed it. Thus, such a fruitful epoch brought new knowledge and points of view about nature; the truth about the environment an era hardly contested (only by dogmatics): the ideas being positively consolidated into convictions, into new, more conclusive paradigms.

Renaissance favoured and supported the anxiety for knowledge of the reality, brought new attainments and gave birth to new paradigms, one of which is the experimental paradigm founded by the English Scientist Francis Bacon (1561-1626) who is associated with the philosophical aphorism "the criterion of truth is the experiment, the practice". The other import spokesman, a man of genius of Renaissance, a man of fine arts, a thinker, a scientist and an engineer – inventor was Leonardo da Vince (1452-1519) who affirmed that thinking, reasoning and decision without experimental proof are fruitless and lack any authenticity.

After the Renaissance, the 18th and the 19th centuries proved the record of the most spectacular discoveries dealing with live nature and its functioning: the scientific basis of systematics (binominal principle) and the concept paradigm of the economy of nature set up by C.Linné, the first theory of evolution (naive and mistaken ever and anon) belonging to J. B. Lamarck, the epochal discovery of mechanism of the organic world evolution created by two British – Darwin and A. Wallace, the coming into sight of Gr. Mendel with his heredity laws and, naturally, the appearance of the new biology of the German scientist E. Haeckel – a special area where the future ecology found its place, a biological science which continues to be considered an amazing evolution.

After Haeckel ecology has passed on through three successive paradigms: antecological – populational – ecosistemical (nowadays). Today the (eco) systemic paradigm became a theoretical base for the environmentology – the science of the environment protection and rational use of its resources.

Currently, due to the logical (successive) evolution of the precedent ecological paradigms, the *ecosystemical paradigm*, which now dominates in ecology, the beginnings of which can be found, as it was already mentioned, in the plain diction of C. Linné – "the economy of nature" , which being handed over to the minds of Lyelle – Darwin – Antipa – Constantinescu – Georgescu – Roegen, with the concept about the *bioeconimics*, have reached the world's top philosophy of sustainable development (ecodevelopment) – the only chance (at the moment) of survival and of ascending and sustained progress of mankind.

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EUROPEAN COMMUNITY ENVIRONMENTAL LAW AND ENVIRONMENTAL RIGHTS

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Au trecut peste trei decenii de când Uniunea Europeană a adoptat primul program de acţiuni pentru protecţia mediului. De la o abordare sectorială, europenii au trecut la elaborarea de strategii de dezvoltare durabilă, integrând mediul în toate componentele politicilor comunitare: Uniunea a adoptat peste 200 de acte legislative, a dezvoltat un sistem tot mai complex de instrumente, a promovat cercetarea şi inovarea tehnologică pentru a găsi tehnologii nepoluante, a dezvoltat eco-pieţe, a încercat să acţioneze la nivelul comportamentelor de consum şi de producţie, s-a implicat activ în acţiuni la nivel global privind reorientarea politicilor economice către o dezvoltare durabilă în toate ţările lumii.

There was no mention of the environment in the original Treaty of Rome. To some extent, this was because the primary aims of the EEC were economic, and, as well, because the potential environmental impact of the expansionist, growth-related economic policies adopted at that time was not perceived.

In October 1972, declaring that "economic expansion is not an end in itself", the heads of the Member States, during the Paris Summit Meeting, agreed that the EC should pay special attention to the environment and create an action program on the environment and accordingly requested the Commission to draw up an EC environmental policy. The Commission responded by formulating the first Action Programme on Environment. This was the effective beginning of what is now a very wide-ranging environmental strategy.

The policies settled in the first Action Programme on Environment were further developed with the entering into force in 1987 of the Single European Act, which inserted environmental provisions into the Treaty. Further, the environmental provisions inserted in the EC Treaty through the Single European Act have since been renumbered and amended through the Maastricht, Amsterdam, Nice and Lisbon treaties.

In 1986, the Single European Act went some way towards reflecting the reality of the situation by amending the Treaty to add a whole new title relating to the protection of environment. To some extent these changes regularized the existing de facto position, but they also had established some clearer constitutional rules than there had been in the past on the extent of the law-making powers and on how decisions were to be made.

The Maastricht Treaty continued the process of integrating environmental matters into the heart of the EC's activities by making further amendments to Treaties. It also recognized for the first time that the development of "a policy in the sphere of environment" is one of EC's main activities.

Further amendments to the Treaty were agreed at Amsterdam in 1997. Although not generally as significant as those made at Maastricht, they continued the development of EC's environmental strategy. Even if sustainable development was not defined, a new main goal of "promoting a harmonious and balanced and sustainable development of economic activities", together with "a high level of protection and improvement of the quality of the environment" became applicable to all policies and all institutions, not only to Commission initiatives.

The principles and objectives of environmental policy established in the Lisbon Treaty remain virtually the same (precautionary principle, polluter pays principle, etc.). The balance between measures to be adopted under what are now the "ordinary legislative procedure" and the "special legislative procedure" remains. In particular, whilst the bulk of environmental measures have long

been subject to co-decision and qualified majority voting, certain sensitive issues are still subject to unanimity in Council, and hence the national veto. 5 As under the existing Treaty, those sensitive matters can be moved to the "ordinary procedure" (qualified majority voting) by unanimity.

The main innovation in the Environment Title is the first Treaty mention of climate change. Climate change was not such a hot topic during the negotiation of the Constitution, and so this is completely new to the Lisbon Treaty. The last indent of Art 191(1) TFEU is amended, so that Article 191(1) now reads:

Union policy on the environment shall contribute to pursuit of the following objectives:

– reserving, protecting and improving the quality of the environment;

– protecting human health;

– prudent and rational utilization of natural resources;

– promoting measures at international level to deal with regional or with regional or worldwide environmental problems, and in particular combating climate change.

On the visibility of environmental policy among the Union's other policies, it is salutary to recall that early versions of the draft Constitution (prepared by the Convention on the Future of Europe7) hinted that the Treaty status of environmental policy could be downgraded, prompting an enormous effort to reinstate environmental policy at the heart of the Treaty. In the final Constitution, the obligation to seek a high level of environmental protection continued to find its place in the Union's objectives in the first part of the Constitution.

The "integration principle" is repeated in the same terms as before, in Article 11 TFEU: "Environmental protection requirements must be integrated into the definition and implementation of the Union policies and activities, in particular with a view to promoting sustainable development". The principle is, though, arguably less "visible" than before. In particular, it sits alongside other similar provisions, for example as to consumer protection, employment, animal welfare and discrimination. In addition, whilst the integration principle is in place, it has not been followed through explicitly in other policies of the Union.

The argument that environmental protection works best if it is part of other key policy areas, rather than an isolated „special interest", is generally accepted. However, Treaty provisions on these other policies, for example agriculture, industry, transport, tourism, contain no explicit reference to the objectives of environmental protection or sustainable development. Most strikingly perhaps, "environmental protection" still does not feature explicitly in Article 36, formerly Article 30, which provides for qualifications to the principle of free movement.

Energy policy is an exception on this front. The Energy Title is new, containing the new Article 194 TFEU. Not only is one of the aims of energy policy to "promote energy efficiency and energy saving and the development of new and renewable forms of energy", but all of the aims of energy policy should be pursued "with regard for the need to preserve and improve the environment".

Among the legal instruments that sets forward individual rights while also addressing the environment we can refer to the Charter of Fundamental Rights. The Charter represents a mixture of civil, political as well as economic, social, and cultural rights and would, through the Lisbon Treaty, have become a legally binding instrument.

However, as the Lisbon treaty entered into force, the Charter had become primary Community law, and thus become subject to the jurisdiction of the ECJ and obviously deserves attention in the context of Community human rights. Although the Charter's provisions do not make reference to any environmental right, a number of observations in relation to Article 37 are relevant. Therefore, the Charter states in Article 37, under Title IV Solidarity, that "a high level of environmental protection and the improvement of the quality of the environment must be integrated into the policies of the Union and ensured in accordance with the principle of sustainable development". Most importantly,

Article 37 does not confer an individual right on the inhabitants of the European Union; the wording of Article 37 is somewhat general and gives the impression of being a policy objective rather than a right.

In addition, the right is specifically placed in the Charter's Title IV on solidarity and not in Title V on individual rights – the seemingly obvious place for such language if it was intended to establish a substantive right to the environment. In this light, the provision seems to add little in terms of a substantive right and appears to merely confirm the objectives of the Community, as set out in the EC Treaty. Moreover, the Charter states that it should not be interpreted to restrict or adversely affect rights and freedoms set forth under international law, including the ECHR. All this being said, we can conclude that the Charter adds little new in terms of a substantive human right to the environment.

Accordingly, albeit the environmental protection was not among the core policies of the EC in its early days, now it has become a central issue.

Due to the environmental provisions in the treaties, EC's institutions have adopted a vast amount of legislation relating to the environment. It should be made clear that the European Community has not expressly recognized nor adopted a substantive human right to the environment. However, attempts have been made and a number of the EC's environmental policy aims have been interpreted as facilitating citizens' rights. Similarly, early attempts by the European Court of Justice (ECJ) to interpret specific provisions in environmental directives as conferring rights on individuals, in relation to the direct effect of such directives, have waned and the ECJ's focus would appear to have shifted away from a notion of individual rights towards one of effectiveness.

The situation is entirely different when it comes to procedural environmental rights, if we are to compare it with the status of a substantive right to the environment under the auspices of the EC. In this very domain, the environmental legislation and policy statements have indicated a strong willingness by the EC's institutions to pursue environmental rights.

For instance, the 1985 Directive on Environmental Impact Assessment (EIA) states in Article 6 that information concerning activities covered by the directive should be made available to the public. Article 6 obliges member states to make sure that the public concerned is given the opportunity to express its opinion in relation to projects covered by the directive. Prior to the El A Directive, a 1975 directive on bathing water quality noted that "public interest in the environment and in the improvement of its quality is increasing" and "the public should therefore receive objective information on the quality of bathing water".

The strive towards environmental rights on the EC level took a further step forward in 1987 with the Fourth Action Programme, which declared that the "Commission will study the need for, and desirability of, a Community Freedom of Environmental Information Act and will make appropriate proposals". The call was answered with the 1990 Directive 90/313 on access to information on the environment. The directive stipulated that public authorities should, upon request, make any information relating to the environment available to any natural or legal person without that person having to state an interest.

Furthermore, public participation and access to environmental information play central roles in the 1996 directive on integrated pollution prevention and control. For instance, the directive states that "the public must have access, before any decision is taken, to information relating to applications for permits for new installations or substantial changes and to the permits themselves" and that authorities shall ensure that the public can comment on applications for permits for new installations or amendments to existing ones.

The 2001 Directive on the Assessment of the Effects of Certain Plans and Programs on the environment strengthened the right to participation. The purpose of the directive is to identify and assess environmental consequences of certain plans and programs before their adoption, in order to

secure the integration of environmental considerations. The draft plans and programs drawn up in accordance with the directive must be made available to the public before they are adopted, and the public must be given opportunity to comment on the plans and programs.

Finally, the directive states that the final plan or program shall take into account the consultations made by the public.

Similarly, the water framework directive from 2001, aimed at regulation of inland surface waters, transitional waters, coastal waters, and groundwater, recognizes the importance of public participation in European environmental law. The directive encourages member states to involve all interested parties in the implementation of the directive as well as to facilitate public participation in the creation of river basin management plans.

Within the European Community's framework of environmental legislation, a strong emphasis on procedural rights is in place, facilitating participation and access to environmental information. This emphasis was further underlined by the EC's accession to the Aarhus Convention. In light of the accession it became clear that changes were needed to the Community's existing environmental legislation on access to information and public participation. Thus, the 2003 Directive on Public Access to Environmental Information (2003/4) was adopted, revoking the existing 1990 directive (90/313). Whereas the Aarhus Convention went beyond the 1990 directive on access to environmental information, Directive 2003/4 in some instances goes beyond the provisions in the Aarhus Convention.

For example, Directive 2003/4 adds specific pieces of information to the definition of "environmental information" that are not included in the Aarhus Convention, such as information on the "contamination of the food chain". In addition, Directive 2003/4 adds the specific access to justice provisions from the Aarhus Convention that relate to refusal of access to information, which were not present in the 1990 directive.

However, the Aarhus Convention not only required changes to the legislation relating to access to environmental information but also to the existing legislation on public participation. This led to the adoption of Directive 2003/35, which provides for public participation in drawing up certain plans and programs relating to the environment. The directive alters the existing public participation provisions in the EIA Directive (85/337) and the IPPC directive (96/61), as well six other directives adopted prior to the Aarhus Convention. The changes include the addition of environmental NGOs to the definition of the "public" and access to review procedures in relation to public participation decisions taken under the directives.

Whereas the legislation in place relating to access to environmental information and public participation is plentiful, the attempts made by the European Community to introduce conformity on the member state level with the Aarhus Convention's provisions on access to justice have thus far failed. The Commission proposed a directive on access to justice in environmental matters in 2003, which is still in the drafting stage. The failure to adopt the directive means that the issue of access to justice in environmental matters, apart from where it relates to the access to the information and public participation directives, remains firmly in the hands of member states' national law.

Although the EC has shown great enthusiasm in imposing such rights on its member states, it has traditionally been somewhat reluctant to apply such rights and legislation to its own institutions. For instance, standing for individuals and NGOs before the ECJ and the Court of First Instance remains elusive, in spite of attempts to broaden it, unless an individual can prove "direct and individual concern". Although this lack of standing could be seen as violating the access to justice provisions in the Aarhus Convention, it is worth noting that every citizen of the European Union has the right to bring a complaint before the European Ombudsman, which is reiterated in the Charter of Fundamental Rights. This would seem to put the EC in line with the Aarhus Convention.

More encouragingly, however, the European Council and Parliament have recently adopted Regulation (EC) No 1367/2006 applying the provisions of the Aarhus Convention on access to information, public participation, and access to justice to Community institutions and bodies. The regulation extends previous Regulation 1049/2001 on public access to European Parliament, Council, and Commission documents, while providing for public participation in preparation, modification or review of plans or programs relating to the environment. The regulation also allows NGOs to request an internal review of an administrative act by the institution.

On the same topic, the Treaty of Lisbon brings new provisions as for the right to information. One element of public involvement in decisions that has received considerable attention recently is access to justice. This is a question addressed by the Lisbon Treaty, although not in the part of the Treaty that addresses "participatory democracy". As the law stands, ordinary private (non-privileged) applicants must be 'directly and individually concerned' by a matter to have standing before the Court of First Instance, which we must now learn to call the General Court.

The interpretation of "individual concern" has been notoriously narrow: the measure challenged must affect the applicant's position by reason of certain attributes peculiar to them, or by reason of a factual situation which differentiates them from all other persons and distinguishes them individually. This largely excludes the challenge of measures on environmental grounds, since environmental impacts are by definition shared. The Court of Justice has confirmed, notwithstanding a devastating critique of the status quo by Advocate General Jacobs, which any change on standing would have to come from Treaty revision.

The Lisbon Treaty has amended access to justice, with a new paragraph 4 of Article 263 (formerly 230): Any natural or legal person may, under the conditions laid down in the first and second paragraphs, institute proceedings against an act addressed to that person or which is of direct and individual concern to them, and against a regulatory act which is of direct concern to them and does not entail implementing measures.

So there is no longer any requirement for "individual concern" in respect of a "regulatory act" which "does not entail implementing measures". Strangely, "regulatory act" is not mentioned anywhere else in the Treaty, and so the extent to which standing is relaxed will depend on judicial interpretation of this phrase. The wording survives from the Constitution, but the Lisbon Treaty does not pick up on the Constitution's re-categorization of EU laws and procedures into legislative acts and non-legislative acts. Quite how this will play out is still to be seen.

It is likely that "individual" concern will no longer be required of decisions addressed to someone else, and possibly even in respect of legislation (although in this case, why refer to a "regulatory act"?) J3. This change has obvious potential to be very significant in the challenge of measures by environmental interest groups.

In addition, Regulation 1367/2006 has the potential to widen the scope of standing before the ECJ and the Court of First Instance. Where an NGO's request for an internal review is turned down, the decision has to be communicated in written form, which arguably constitutes a "decision" in the meaning of Article 230 of the Treaty, which in turn allows for access to the ECJ and the Court of First Instance. It is worth noting that the access to information provisions for EU institutions have been included in the Charter of Fundamental Rights, which in Article 42 states that any "citizen of the [European] Union, and any natural or legal person residing or having its registered office in a Member State, has a right of access to documents of the institutions, bodies, offices and agencies of the Union, whatever their medium".

Thus, the European Community has directed its attention more toward procedural environmental rights than toward a substantive right to the environment. Where the Community has made attempts to accommodate a substantive human right, this has taken the shape of a policy statement rather than

a specific right. However, the role of the procedural rights within the Community is strong; although access to information legislation has a longer history in the United States than in Europe, it is indicative of the Community's commitment to procedural environmental rights that they have been part of its environmental legislation for the best part of twenty years.

These procedural rights have the potential to achieve the same positive environmental behavior as substantive rights in terms of citizen enforcement. Additionally, they will help shed light on the vague right enshrined in the Charter of Fundamental Rights and facilitate focus on a substantive right. The procedural rights of the European Community add to and support the focus on environmental rights in Europe, which are increasingly recognized in a large number of national constitutions.

With regard to environmental liability, there have been a number of approaches during the past few decades which aimed at the establishment of environmental liability in Europe. On one hand, there is the "Convention on Civil Liability for Damage Resulting from Activities Dangerous to the Environment", Lugano, 21 June 1993. This so-called Lugano Convention – a convention of the Council of Europe – focuses on environmental liability in Europe for activities which constitute a threat to the environment.

On the other hand, various concepts about environmental liability have been brought forward by the Commission of the European Communities – for example a proposal for a Directive on Civil Liability for Damage Caused by Waste in 1989. An amended version of the proposed Directive was published by the Commission in 1991. However, neither the Lugano Convention nor these Directive proposals have entered into force. Especially in the light of this, the adoption of the Environmental Liability Directive in 2004 is of vital importance for environmental liability in Europe. It is of pivotal significance not only with regard to European law but also for the national laws of the Member States. Based on the polluter pays principle, its basic idea is to require the (potential) polluter to prevent and remediate damages to nature.

To conclude, the European Environmental Liability Directive comprises remarkable regulations on liability for damages to nature which have a massive influence on the national law of the Member States. Although the Directive is far from being perfect, it is at least a very important step towards the enhancement of liability for environmental damages.

In conclusion we can mention that the strong focus on procedural environmental rights of access to information, public participation, and access to review procedures at the regional level, as embodied in jurisprudence from the European Court of Human Rights, the Aarhus Convention, and environmental policy and law from the EC, has led to these rights today enjoying the status of regional customary law.

Also, whereas international progress toward a substantive human right to the environment has come to a standstill, developments in Europe have countered this. Although recognition of a substantive human right to the environment on a regional level in Europe is taking place in a cautious and step-by-step process, this aides the precarious status of a substantive right under international law. This is particularly so in light of developments on the national level. Here European law can add to customary norms already in place in places such as Africa and Central and South America. In addition, the emergence in Europe of procedural environmental rights as part of regional customary law has the potential to add further weight to a substantive international environmental right. For instance, this is recognized under the Aarhus Convention, where the aspiration of a substantive right is to be pursued through procedural rights. Thus, discussions on the status of a potential human right to the environment in international law are likely to benefit from the embracing of procedural rights and the various European approaches to a substantive right.

Environmental protection is one of the most serious tasks to be dealt with in the days and years ahead, and in tackling this issue, the question of how environmental norms development is an

essential topic for consideration.

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COMUNICATION IN THE LIVING WORLD AND ITS ECOLOGICAL SIGNIFICANCE

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Communication is an essential attribute of life. Even the smallest creature cannot exist without communicating with its fellow creatures and without entering into dialogue with its immediate surrounding habitat. This means that all living beings are able to emit and to pick up signals.

Irritability is another attribute of life. This is the ability of living beings to pick up different signs and signals coming from the environment and to work out true answers. In animals endowed with nerve cells, we speak about excitability; this being the ability to truly respond to the action of stimuli (signs and signals) coming from the external or internal environment. The excitant is the energy capable to take out the cellular membrane from the repose state and to release the elaboration of some adequate responses. The adequate response appears only when the decoding of signs and signals coming from the environment is corresponding. In environment, there are endless signs and signals that act as excitants, but they cause adequate responses only when they are correctly decoded. Flowers are beautiful and attract not only by shape and colour but also by their scented perfume and by the aromatic, sweet and nutritious nectar; all these are signs and signals released by flowers to be decoded by some creatures, we can say that they have precise addresses. Of which beings? Of man? Man can be attracted and can decipher in his way these signs and signals, but he can only enjoy, admire and often break the order to have them more time around him. This is not the message transmitted by flowers; they seek to attract the pollinating insects. There are beings that decode these signals correctly (insects, birds or bats) and visit the flowers with pleasure and interest, achieving the pollination too.

Communication can be achieved by different mechanisms: chemical, physical, bright, sonorous, up to the articulated language characteristic to man. The language consists in the concatenation with meaning of some signs and signals regardless of their nature.

The signs, the signals and their deciphering stand at the basis of the behaviour of all living organisms. In the last two centuries, there has emerged a science of deciphering the signs and signals of the living world that is biosemiotics. The biosemiotics is a branch of semiotics which deals with the decoding of messages transmitted through signs and signals.

When we speak about biosemiotics, we turn our attention to **Thomas A. Sebeok** [5], **Jakob von Uexkühl** [6], **Jesper Hoffmeyer** [2], **Claus Emmeche** [1] and so on, those who substantiated the science destined to facilitate the understanding of vital structures and phenomena.

Discursiotics proves that there is communication at all the levels of nature. In its simplest form, the semiotic discourse appeared together with the process that generated the first living beings. **Over time,** the prebiotic processes have gained an increasing autonomy and created a complex semiosphere that, after 3.5 to 4 billion years, is able to generate such semiotic systems as thinking and language.

The species do not live in isolation but they are in constant interaction: A semetic interaction, which means that the signals transmitted by a species are picked up, interpreted and used by another species. As I mentioned before, the rabbits have learned that the fox-do not hunt a rabbit if it was seen from a distance. In this situation, the rabbits do their best to signal to the fox that it was seen. **Thus, an ecosemiotic discourse is achieved**. The individual or the species will achieve more ecosemiotic discourses, as the freedom of their action will become greater.

We must understand that the semiotic relationships are not at random, but they are realized coherently and they represent a widespread phenomenon in semiosphere.

Like the rabbits, the other species too achieve semiotic discourses with the species with which they come into contact. The semiotic discourses are more complex, the communicative network is greater, and, consequently, the respective biological system is better defined and more stable. We must understand that we cannot speak of a living being if it is notable to enter into dialogue with its universe.

It is known the fact that the bees communicate perfectly in their actions, using a very special language, characteristic dances, with movements of a special type designed to offer certain information (where they found a source of nectar, what is its quality and in what quantity and about how many bees are needed for harvest).

Ants also communicate one to each other using a particular language practiced by antennae, known to us as "the parade of crossed antennae".

These types of languages, no matter how lapidary they would be, are full of content and offer accurate and sufficient information.

In order to be convincing in this regard, we relate a true story. Two biologists were on an expedition in the Taiga. The hard and tiring road became harder too because of thousands of mosquitoes attacking them constantly and tithing their blood and that of their horses. Once, they made a break and tied the horses to some pines. One of them noticed hundreds of mosquitoes set to the stem of a pine; they had enormous bellies, of bloody colour, ready to burst from so much blood consumed. He tried to grab one, but the mosquito did not emit any defence reactions. It was in a lethargic sleep. Understanding this aspect, an idea flashed him and he took action. He searched on the ground and collected three ants. He showed them to his colleague and put them on the pine trunk among lethargic mosquitoes, without confessing his intentions to the colleague. The ants recovered senses pretty quickly, but at first seemed to move chaotically. Then, they began to concentrate their movements and to circulate among mosquitoes touching them with the antennae. They created the impression that they inventory them. After they have reviewed all the mosquitoes, they went on their way to the anthill. The friends commented with interest the behaviour of the ants, then they minded their own business. After about 30 minutes, when looking again at the mosquitoes, they have noticed a column of working ants climbing on the stem of the pine targeting the "colony" of lethargic mosquitoes. The surprise was not small, when they noticed that the ants, grouped by 3-4, began to immobilize the mosquitoes and carried them on their back. In about 10 minutes all the mosquitoes were picked up by the battalion of ants and these began to make their way on the well-marked paths. It seems a story of S.F. type. It just seems, but it is truly real (we cannot doubt of the sincerity of the narrator). What does it seems to us downright fabulous? The capacity of ants to gather information, to transmit to theirs and to achieve a "commando troops" to put into practice a well thought action. The column of ants was not smaller or bigger than the concrete situation. The target was well located, the landmarks well-chosen and the proposed technique and the development of the plan of action were quite as it should be. The three ants started to work after they have brought back to senses (after the shock they suffered when they were collected and placed on the pine trunk). They checked almost all the mosquitoes, understood the condition in which they were, inventoried the small population and certainly they chose the most indicated and shorter way in their shifting to the ant hill. In their work done among mosquitoes, the ants often met and touched each other with the antennae (they were communicating).

When reaching the hill, they presented their discovery. There was necessary to be convincing and proposed an action plan. The plan was accepted, and there was made the "commando group" and they went to work. The success was great, even the biologists were impressed.

There is no need to insist that all this "epic" of ants was based on a very good language, with a logical structure and with a high efficiency. It is not about a semiotic discourse, but about a narrative,

extraordinary essay. Maybe some persons doubt our interpretations! We wish to amaze those less informed saying that the ants are able to grow mushrooms in ant hills; they seed them and take care of them in specially designed gardens where mushrooms are provided all the ecological conditions required at optimum. Where do the ants know from the necessities of mushrooms concerning temperature, moisture, aeration, the nutrient bed, etc.? From where? From the semiotic dialogue achieved among them.

They drive „herds" of butterfly larvae to grazing during the morning and they bring them back, „milking" the sweet and nutritious juices which the caterpillars secret and remove them by special hairs. Here, the communication is perfect and performant.

What to talk about "ant cows", the aphids reared during the winter in the ant hill to ensure the "milk" that ant's need (it is about the sweet and nutritious dejections that ants are looking for and eating with pleasure). The semiotic discourse must be seen as a symbolic order, connecting the subjects in a common universe.

Analyzing from a biosemiotic point of view the relationships among organisms, we find out that, in their behaviour, the species do not emit only separate words or phrases, but they realize a semiotic discourse (ecosemiotic).

Understanding what is a ecosemiotic discourse and what is its significance in the relationship to other species, we discover the fact that, among the species of a biocoenosis and even among the individuals of a species, it functions a multitude of such discourses, forming a more or less complex network, but also, when we want to define correctly a species it is necessary not only to know the **ecological niche**, but the so-called **semiotic** niche too. As the ecological niche is the creation of each species in part, so the semiotic niche represents a creation of a species in its relationships with the other species.

Within a biocoenosis, among the species, a semiotic network is formed and operates, depending on which the biocoenosis takes shape and becomes sustainable. From the ecosemiotic discourse, thus, we reach —a **semiotic network** and from here the whole which the living represents, **the semiosphere**.

As **Jasper Hoffmeyer** noted [2], life was from the beginning dependent on a number of significances and even if the structure of cells or organisms is describable in anatomical, histological, cytological or biochemical terms, that it does not mean that we really understand these structures, if we do not consider that they were developed in a period of billions of years under the guiding logics of semiotic interactions (semetic).

Jasper Hoffmeyer [2] drew our attention that the modern unification of biology should be based on the biosemiotic foundation of life.

He also studied thoroughly the characteristic structures of the Vital and their biosemiotic significances, trying to establish some guiding principles in the deciphering of vital, when we follow the path of biosemiotics. His guiding principles for the semiotic understanding of life were bundled by some of his disciples, and presented under the form of those 13 theses, which outlines his biosemiotic thinking.

In his work **Rethinking Biology,** published in 2002, the University of Tartu, Estonia, **Hoffmeyer** and his close collaborators, **Claus Emmeche, Kalevi Kull** and **Frederik Stjernfelt,** present those 13 theses outlining the biosemiotic thinking of **Hoffmeyer** and direct the research in this area.

Once we introduced ourselves in the sphere and content of biosemiotics as science and we sensed its significance in the understanding of structures and vital phenomena, it follows the effort to understand the guiding principles of this science.

In what it follows, we shall present the 13 theses of Hoffmeyer and we will try to outline the sphere of contents. Theses are:

1. **The signs, not the molecules are the basic units in the study of life;**
2. **The codes of the living beings are dual;**
3. **The simplest entity possessing real biosemiotic competences is the cell;**
4. **The living systems consist of surfaces within the other surfaces which transform the inside in the outside and the outside in the inside;**
5. **Subjectivity is more or less a phenomenon;**
6. **Subjectivity is embodied;**
7. **The living organism is a swarm;**
8. **Everything an organism feels has a significance for it;**
9. **Any new habit tends to become a sign;**
10. **The totality of the "contra punctual duets" forms the sphere of communications – the semiosphere;**
11. **The semiotic niche is the home of species;**
12. **In the living systems, the determination is built on indetermination;**
13. **The biological evolution is a growing tendency of the semiotic freedom.**

1. The signs, not the molecules are the basic units in the study of life

The first thesis formulated by Hoffmeyer imposes clearly the biosemiotic approach of the vital structures and phenomena. If in the understanding of the structure and function of living organisms there was used the analytical method, reaching what we now call molecular biology (starting, in the study of living things, from morphological analysis to that anatomical, from here to that histological and cellular and then continuing with the study of cellular organelles and of macromolecules, there were reached up the observations on the electronic structure of the vital support), the biosemiotics draws our attention that each structure has a certain significance in the emission, the reception and the interpretation of some signals. Not only the structure, but the quality and the significance of signal present importance in the vital phenomena.

Hoffmeyer [2] draws attention to the fact that signals are the basic units for the study of life, which means that biology is a semiotic science.

Only through the structure of some organs, tissues, cells, organelles, macromolecules, etc., which interact according to physical forces (mechanical), we will never come to understand life in its intimate structure and functionality. If, however, we will try to include in an elementary model of a biological process, all that is necessary for the model to be an alive one, then it will appear as a set of features, among which we shall include too, the characteristics of signals or of the signalling processes. The semiotic meaning is achieved if we shall include in it the features of this model. The model does not represent an amount of structures, but a complex of signals with vital significance, encountered in an organism. The essence of biosemiotics is the understanding of biological models and the patterns of activity of which the organisms are built.

Organisms are constructors of models in conformity with which they know the reality. They emit and perceive signals with certain significance.

The DNA is not just a macromolecule, but, as the bearer of a certain biological significance, it is more than that. The signals they emit may have certain significance for the cell, for the tissue to which the cell belongs, for the organism, or even for the species, within the biocoenotic complex. The synthesis of acrasin by Dyctiostelium mucuroides represents a major signal for the saving of populations in the moment of the appearance of some restrictive environmental conditions.

The message (signal) released by DNA is interpreted differently on different levels (cellular, histological, organismic, populational, biocoenotic).

2. The codes of living beings are dual

Any signal means information, means message. It has a meaning, it is addressed to someone and it must be decoded in order to be used. The living organisms come together and interact with each

other using either analogical codes (in the ecological space), or digital codes, which, in time, function as messengers for the future generations.

Life as a cosmic phenomenon could not appear but by combining the two types of codes: analogical and digital. The principle of the dual code can be considered a definition of life. Life is like a computer with its afferent software.

The dual code presumes an inevitable reciprocal, genetic, and ecological influence, dynamic and synchronic, vertical and horizontal, etc. in the functioning of organisms and of life as a cosmic phenomenon. According to **Hoffmeyer** [2] the dual code can be represented symbolically by the ratio between egg and hen, the egg embodying the essence of the analogical code in which the phenotype was concretized.

Life appeared from nonlife by an endless chain of events, in which the two codes have functioned: a code of action (behaviour), of an analogical type, and a memory code, of digital type.

3. The simplest entity possessing real biosemiotic competences is the cell

From the semiotic point of view, the cell is the basic entity in which the vital phenomena occur. Through its structure, the cell provides the material support for different types of signals. It is not just about the signals included in the hereditary patrimony represented by nucleic acids, but also the complex structures of the organelles and the intracytoplasmic functions. The cell is the semiotic system that makes the difference between the inside and the outside, opening the possibility of communication with the environment through the membrane phenomena.

The dual analogic–digital informational system appears in the cell as a self-regulation system based on the re-description in the digital code of the nucleic acids chain.

The semiotic quality of life is the magnificent organization and development of the cellular metabolism.

4. The living systems consist of surfaces within the other surfaces which transform the inside in the outside and the outside in the inside

The importance of the border areas, of limit, among different systems was often emphasized, not only by semioticians, but also by biologists. Life is a phenomenon that takes place at the level of surfaces. Fundamentally, life is the relationship between the inside and the outside. Not accidentally, in the cell of eukaryotes, endless membrane surfaces are found, offered by most cellular organelles and, especially, by the endoplasmic reticulum. In the animal world, membranes with a particular biological significance represent the embryonic thin membranes of diploblastic and triploblastic organisms.

The crucial events of the macroevolution and individual morphogenesis are produced by the contact relations among the cellular surfaces and those of the tissue surfaces. The surface is transformed in interface, connecting the inside with the outside. Only in this way, the biological systems come to understand the environment, because the relevant parts of the environment become elements of inside-outside inter-analysis. Moreover, the world phenomena, or the perceptual models, those called by Uexküll (1930) as Umwelt represents, at the same time, that the inside becomes the outside and the outside becomes the inside in the ecological niche. As a matter of fact, the degree of freedom of beings to the surrounding environment depends on the mode in which the external environment becomes an integrant part of the internal environment.

This double connection inside-outside allows the membrane to govern the exchange between the two sides, making possible the essential intentionalities. The semiotic looping of the organism and the environment performed at the level of the interface of the induced membranes ensures the stretching of life roots towards the future, in the struggle between growth and multiplication.

5. Subjectivity is more or less a phenomenon.

We can say that the subjectivity involves different degrees, that presumes the understanding and control of the notion of subject in biology. As in philosophy, it is about the experience lived by the

subject, by the proper and incommunicable experience, felt directly by a human being. Each sees the world in his own way, from his point of view, based on his/her own experience. The character of subject is a basic feature of an individual. We ourselves are subjects once we have our proper indivisible dimension.

Each subject has its own natural history, which corresponds to the natural history of the meaning of signs. Semiotic dimensions of the subjects exist in all organisms because all emit, receive and process the signals with a certain significance. Thus, in evolution, there is a general semiotic continuity. Evolution has allowed the possibility of appearance of the new forms and of some new code systems (like the communication of animals, human language, the great dual code in the biological evolution).

6. Subjectivity is embodied

Intentionality, subjectivity and self-knowledge are not inaccessible phenomena to science. The scientific understanding key of the mind is the embodiment of existence and not the fiction of symbolic decorporalization of an organization as it appears in the classic artificial intelligence.

The unity of consciousness is a function of the historical oneness of the body. The body performs interpretations of new situations that arise in peristalsis. Subjectivity is an emanation of the organism organization, as a result of a semiotic process of interpretation of signals received in the context in which the body lives. Intentionality of human mental life has evolved depending on the history of the interrelations established with the surrounding world. It was present in germs in our many relationships established in the geological time with the animals.

7. The living organism is a swarm

According to **Hoffmeyer,** the complex problem of pluricellular organisms can be understood by the concept of swarm, that is a set of mobile agents that are capable of direct or indirect communication with each other (in accordance with the local environmental characteristics, and which solves collectively the enough complex problems of the whole).

From this point of view, we can achieve a fertile analogy with the social animals, the pluricellular organisms appearing to be composed of multiple swarms, hierarchically organized . In other words, the swarms of cells forming the organism of a pluricellular animal can be imagined as a swarm of swarms, as a grandiose swarm formed of different swarms hierarchically overlapped. Such an image can be offered by the integrated functionality of the brain in the body. With good reason, Hoffmeyer believes that, for the maintaining of the somatic ecology, the swarm of cells with the role in the immunity interacts with the swarm of nerve cells.

The cells that make up the organism do not form a state within a state, but they are rather isolated. They communicate with each other, enter into action and combine their efforts to ensure the immunity or the optimal functioning of the body, especially in the periods of stress. It is downright impressive the multitude of cells with the role in active defence of the organisms and their ability of communication and mobilization to achieve a unitary goal – the immunity ensuring.

According to **Jacob Uexküll** [7], through differentiation of cells and tissues, the pluricellular organisms have acquired a greater capacity to receive and transmit information, so to handle larger portions of the environment, both in time and space, allowing the growth of the so called Umwelt.

As it is well known, there are a multitude of cell types in the body structure that are mobilized to fight against the pathogenic agents that enter in the organism and threaten its existence. All these cells cannot carry out the function of the body's defence if they do not operate like some semiotic systems, if they are not able to communicate among them, to emit and to perceive the "mobilization" signals.

The relationship among the body cells is outlined as a **symbiotic mutualism**, which it operates on the biosemiotic principles. In its totality, the situation presumes the existence of a common

interpretative universe. The ecosemiotic discourse stands at the basis of the relationships among cells, thus ensuring the edification of a complex system – the pluricellular organism.

8. Everything an organism feels has a significance for it

Hoffmeyer attributes this statement to Uexküll.

Each action that consists of perception and operation, prints its understanding on the objective knowledge, and thus, it makes sense that the subject relationship to complete the meaning of a message from the perspective of Umwelt.

We do not need to anthropomorphize the understanding and behaviour of the inferior organisms in the environment, but we must admit, as I have previously stated, that a living being has to enter into relationship with its environment, it must develop a so-called Umwelt. Entering into dialogue with its universe is like the organism would feel it and would think something about it.

A bacterium that has a very simple cellular structure, living in a certain environment, it feels it, measures it and tastes it. It seeks nutrients it needs for growth and development and avoid certain noxious factors of the environment. The bacterium has under control its environment and, as a result of the exchange of information, it understands what is happening in the environment and it has an adequate behaviour.

Dyctiostelium mucuroides communicates with its neighbours and it controls the environment. In the moment in which it finds out that the environment is exhausted of food, or that a noxious agent can penetrate into it, it launches an alarming signal to its neighbours in view of breaking a deadlock and the salvation of the population, even if it presumes certain sacrifices.

9. Any new habit tends to become a sign

Almost any new item that appears in an ecosystem will be, sooner or later, recognized and used by certain organisms. This is the reason that an ecosystem can stay in balance, even if new substances (not seen before in the history of that universe) are produced, and new relationships are established.

Hoffmeyer [2] considers that anywhere a new habit appeared there will be an organism too for which this habit represents a signal. He considered this statement a rule, and indeed, it can be interpreted as a version of a natural law, as **Charles Sanders Pierce** thought too.

Anyway, this is a principle of semiogenesis that stipulates that any tendency of interconnection in the ecosystem should be of broad perspective in the biosphere.

The living systems show evidently a semiotic behaviour based on the dynamics of semetic interactions. By this, the habits seem to signify the production of future habits in the endless and long networks stretched back up to the beginning of life and forward up to the global future semiosphere.

10. The totality of the "contra punctual duets" forms the sphere of communications – the semiosphere

Biosphere is understood as a global network of interconnections, as a circuit of chemical elements through organisms and the environment (biogeochemical circuit). There remain many aspects which are beyond our understanding. The chemical structures, the mineral and organic structures have intrinsic value, not so much by their composition and organization, as by the signals they emit and their significance. One and the same chemical substance has totally different meanings in various different contexts.

In Dyctiostelium mucuroides, the acrasin becomes an alarming signal, but only in the presence of imminent danger. In other contexts, the same chemical substance does not have any semiotic significance. Thus, in order to be able to understand the living world in its fullness, one imposes that the notion of biosphere should be added that of semiosphere.

From the semiotic point of view, the biosphere has a component totally particular – the semiosphere. Moreover, T.Sebeok [5] stated that "the Biosemiotics presumes an axiomatic identity

with the biosphere". In this situation, the semiosphere must be seen as a sphere that covers the earth, formed of the totality of interconnected signals that form the language of nature.

11. The semiotic niche is the house of species

The semiotic niche is a processing of the ecological niche. In the modern interpretation, the ecological niche represents the historical creation of each species, which means that the niche is multidimensional, that it has many facets, or that it is formed of multiple measurable parameters that can differentiate a niche from the other one. Equally, this also means that we cannot speak about available or occupied ecological niches. It is possible an overlapping of niches, but not totally. In other words, each ecological niche defines a species.

We can easily realize that the shape of a niche, the semiotic dimension misses. Each population (species) possesses certain specific semiotic abilities, by which it differs from other populations (species). The signals with a certain semiotic significance, so with a certain vital significance, differ the species and even the populations among them within a polytypic species.

From here, we can deduce that in order to keep it in the semiosphere, each population (species) must occupy a certain semiotic niche, or better said it must create itself a semiotic niche.

The semiosphere imposes the limitation of the Umwelt of resident population, in the sense that, for its maintaining in a certain area of semiosphere, the population must shape its semiotic niche to master a set of signals of visual, acoustic, olfactory, tactile and chemical nature with semiotic significance that ensures the survival in the semiosphere.

Thus, The Umwelt and the semiotic niche are two different sides of the same phenomenon.

12. In the living systems, determination is built on indetermination

Instead of a world harmoniously structured, from a collection of materials and mechanical links, rigorously ordered, the reality of signals with semiotic significance introduces us into a disorderly world, in a mixture of processes and of signals in a certain direction. The Newtonian world picture, representing a massive, sustainable, solid, impenetrable world, composed of moving particles, one breaks up and appears to us as a world in which the indetermination and the spontaneity reign.

The indetermination is present in the biosphere and in semiosphere, as the order is which ensures a total determination and distinction. The indeterminate organisms have the capacity to carry on or open their edges (limits), which allows them to continue the growth and to change their indefinite models.

In the symbiosis among different species, the processes of delimitation-fusion, delimitation-sealing and delimitation-redistribution determine a greater persistence of organization in which the enclosed individuality becomes diffuse. The semiotic analysis of the living organisms proves that the symbiosis or the symbiotic mutualism is considerably more widespread in the living world. And it is not only about the symbiotic mutualism among the partners of the different species, but also the established relationships even among the cells of a pluricellular organism.

Individuality and mortality are wider interconnected and the dynamics of bounds among partners, in time and space, is not always imposed by genetic sets. The building of the organism of a pluricellular animal is carried out by cellular births and by the death of some categories of cells. The cellular apoptosis appears as natural condition imposed by the building a functional whole.

The limit between determination and indeterminacy is difficult to establish, as equally it is difficult to establish the flow of transformations that leads, in evolution, to the emergence of determination as biological progress.

13. The biological evolution is a growing tendency of the semiotic freedom

The edification of our universe has been governed by the tendency of living systems to ensure (without coming into conflict with the laws of thermodynamics) all more freedom or autonomy. Analyzing from the cybernetic point of view this characteristic of the living world, we easily surprise

the fact that the living beings are governed by cybernetic mechanisms (*feed-back and feed-before)*, which ensure them not only a certain degree of freedom in the cosmic ocean, but also the choosing the most favourable way in the process of evolution.

The semiotic dimensions of living systems ensure a more advanced degree of freedom, which leads to a semiotic freedom designed to strengthen the system and ensure its sustainability.

The semiotic dimension of living systems is based on the organization of the structural and functional constituents and cannot exist without this basis. The combining of advantages offered by the digital code with those given by the analogical code ensure to organisms a degree of freedom to the environmental constraints, practically unlimited, depending on their degree of evolution.

Communication in the living world represents a reality and it is found in all the groups of organisms regardless of their position in the genealogical trees

Communication is an essential condition of life. This is not achieved only among individuals and their abiotic and biotic living environment, but also at the level of structural elements of organisms. There is a communication among organs, as there also exists among cells and even among the component parts of the cell.

If the organism needs the synthesis of certain substances (enzymes, hormones, bioactive substances, etc.) then, there will be given a command to the secreting cells from the level of the specialized organ to synthesize the respective substance. It is not about a general order, but an accurate one: what substance, in what quantity and where to be sent. By special orders, the secreting cell is activated. It is activated the responsible gene for the synthesis of the substance. It is ordered immediately the messenger RNA synthesis to copy the information. By other orders this is matured and sent to the cytoplasm at the place of synthesis.

By special orders there are mobilized all the cellular structures that ensure the synthesis of the respective substance. The communication is precise, continuous and kept under a rigorous control. It is nothing carried on randomly. All phases are carried on based on the semiotic dialogue among the intracellular structures. If we introduce into the respective cell a certain amount of substance which it synthesises in the respective moment, then the synthesis is interrupted; an analysis of the created situation takes place, and, if it is found that a certain amount is necessary to be synthesized to ensure exactly the received order, then, the synthesis continues.

If the amount required was exceeded, the synthesis process does not continue any more. Nothing is all out randomly. All processes are controlled by different signs and signals which are correctly interpreted. The semiotic dialogue that takes place among the intracellular structures is permanent, functional, correct and efficient.

There is no biological system that does not ensure its functionality on the basis of communication, either individual or population (species), biocoenosis and biosphere.

The majority of migratory animals (crustaceans, insects, fish, birds and mammals) organize their migrations on the basis of the semiotic dialogue that is achieved through signs and signals of a special type.

The symbiosis phenomenon is achieved only and only on the basis of semiotic dialogue among partners.

The social life of animals cannot be understood without a semiotic dialogue among partners. A whole semiotic network is realized among partners, what leads to a characteristic semiosphere. In the evolution of vital phenomena we must take into account not only the so-called biological evolution, but also the evolution of communication of organisms with fellow creatures and with the universe.

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INDIVIDUAL ENVIRONMENT AND ITS BUILDING

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Life appeared in the aquatic environment, but not before being prepared for the emergence of the first living beings. Since the emergence of life the whole Planet Terra has been modified in the relationship between biotic and abiotic.Biosphere represents life as a planetary phenomenon, and the life has as environment the Ecosphere . Both the vital phenomenon and Ecosphere had a coevolution during the geological time. Biocoenosis together with its biotope form an ecosystem. Ecosystem is the most beautiful and compelling example of what it means the unity of life and its environment, whether we think of ***bioskene, biochorion or biome****.The species occupies a certain area, which represents its life environment (the entire complex of abiotic factors). Also , the individual has its life environment. We should call it* ***habitat,*** *but this term is often used differently in different comprising spheres.However, every living being, every individual, regardless of what species, Phylum or Kingdom is part of has its life environment, a proper environment,achieved by selection in a much more comprehensive environment.This environment has two parts harmoniously combined, forming a unitary whole: the* ***Umwelt*** *and the* ***Innenwelt*** *.*

So in one and the same environment (broad) each species realizes its own living environment as each individual realizes its life environment in a broader environment in which it lives.

Key words: environment, individual environment, Umwelt, Innenwelt, internal environment.

Introduction

The notion of environment or surrounding environment was introduced in the strict ecological sense by the German biologist Jakob von Uexküll [25, 26] in his **Teoretische Biology**. He defines the environment as being **"Umgetung"** – the outside world that surrounds the living beings in proportion as it is perceived by sense and locomotion organs of animals and also the outside world imposes them certain behavioral actions.

As indicates Ion Dediu [4]: "*each species* ***"choices"*** *from the general environment those elements which correspond , on a small space , in the most useful way of its genetic nature".*

The same author, Jacob von Uexküll used the notion of Umwelt, by which he understands the specific environment or the efficient environment of a being. This term would be widely used in biosemiotics. The efficient environment represents those components of the general environment that have a direct influence on the life of a living organism.

We want to strengthen Jacob von Uexküll's conception on the environment with emphasis on the fact that an individual (a being) chooses from the general environment those elements that correspond to its requirements. It was easily passed over this aspect in the interpretation of the living environment.

[1] considers that the efficient environment represents those components of the general environment having a direct influence on the life of a living organism.

Out of those presented we must deduce that the surrounding environment is a subsystem of factors with which other subsystem interacts, the living one and that which, taken together, due to relationships (mutual exchange of matter, energy and information), forms a unitary and inseparable system, composed of these two subsystems: the organism and the environment [4].

The environment – organism unity does not consist only in the fact that the organism lives in the environment, but that it takes from the environment, by selection only of those elements it needs and only to a certain extent, shaping the environment in such a way to be in its favour.

In fact, as Jacob von Uexküll demonstrates us the individual lives in a more comprehensive environment in which it is building its own proper environment, an individual environment. This

individual environment is the s**pecific** or **efficient environment** of the respective being and represents the so-called **Umwel**t.

Because of the interaction between organism and environment the individual is able to assimilate certain elements from the environment, to internalize them, so to transforme the external environment into the internal one. This internal environment enriched with elements taken from the environment represents the so-called **Innenwelt**. As we will see, the Innenwelt is not equivalent to the notion of internal environment currently used in the animal and human physiology because it is the resultant of the interaction between organism and environment.

In the following we have proposed ourselves to present the interrelations between Umwelt and Innenwelt and to elucidate certain aspects referring to the building of internal environment.

Individual environment building

If by environment we understand the surrounding nature or the totality of abiotic and biotic factors with that a living being is in contact, then we must understand that all the living beings that live in a certain environment need the same living conditions? In a water basin there live beings belonging to different Kingdoms and even from different regions, we can realize that their claims to life are different.

We can not doubt about the fact that the creatures from the respective aquatic basin, being aquatic they can not live but in water, except the fact that some could be amphibious. What we want to nuance here is the fact that in one and the same aquatic basin the life requirements can be different from one species to another and even from one individual to another.

Some still believe that all organisms living in the same environment shall enjoy the same conditions and that they use in the same extent the same environmental factors. Though they live in the same environment (more comprehensive), the individuals of a species realize their own environment by selection, depending on the interests, needs and proper capabilities. So, every species, every individual living in the same environment uses to a certain extent its factors, as they would create their proper environment.

Certainly Alexandru Dragomir [6] is right when he states that: "*Always the environment belongs to someone, it is proper to someone"*.

We all know that in a glade sheep eat certain plants, goats others, rabbits have other preferences and we can continue in this sense. It is as if each animal would choose the favorite food. We can think in another way: the plants are attacked by different phytophagous species, some **polyphagou**s species attack very many plant species, others, that we call them **olygophagous** species, prefer a small number of plant species and few species do not use for food but one species, being **monophagous**. We realize that the phytophagous species choose their only preferred plant species. Moreover than that, if several phytophagous plant species attack the same plant species, then they attack organs even different tissues not to get too much in competition. From here we can deduce that the environment can offer endless possibilities that can be exploited by living beings.

Such preferences are for other environmental factors, too (nature of soil, humidity, light, air currents, etc.).

Things seem to clear up: each species, as well as each individual living in an environment use certain factors in a certain extent, building their own environment in a more comprehensive one. **Environment is a proper creation of each species and each individual, and it is done by extracting from a broader environment of the factors that they need to ensure the existence and adaptation.**

The building of the own environment (individual) is performed by the interpenetration of the external environment with the internal environment.

The internal and external environments must be understood on the direction of Jacob von Uexkülls conception of **Umwelt** and **Innenwel**t, which means the penetration in the semiotic

universe. Applying this thinking way we shall understand that every being becomes an individuality as a result of its ability to decode more or less the signals coming from the environment and to integrate them into its Umwelt. This thinking way must be applied to all species and all individuals, regardless of taxonomic group of which they belong.

"An amoeba is a temporal creature being able to distinguish and act on the selective features of the environment, and to participate in the incorporation of the present in the future" [10].

To strengthen Hoffmeyer's affirmations, we mention that Shapiro (1988) considered that "*the bacteria develop behavioral skills and they are able to process and respond to external signals*", and Sorin Sonea [24] describes the bacterial world as "*being similar to a global organism which, even if it is dispersed, is bound by a general exchange of information among bacteria*".

The indiviual environment presents, alongside of Umwelt , an Innenwelt ,too, that defines it, and that is integrated into the wider environment [26, 3]. Being the problem about Umwelt, as it was understood by Jacob von Uexküll, we realize that we talk of an environment that not only we realize it, but we assimilate it, too. It is actually, what a child begins to realize after birth, he begins to select from the appropriate environment in which he exists, only what it is necessary for him, which has a major significance for him. Child after birth begins to create his own environment, an environment in which he learns to move and live. He discovers his mother, first mother's breast and then the facial expression, the voice timbre and warmth of his body, he discovers his hands and later his feet (he tastes them, he puts them into his mouth), the sucking bottle with babyṣ dummy and so he broadens his horizon from nearly too nearly. He approaches those from around with his social smile before enjoyning and smiling consciously, he forms his own universe, of which he needs, in which he lives, which it then expands to beyond of maturity. How many things are around him of which he does not need, these do not enter within his Umwelt.

My environment belongs to me. I feel well in a place or not: my clothes fit me and start to become part of me, to represent me; I can wear anything, but not with the same pleasure with which I wear those that like me; I can eat anything, but not any food is favourable to me and I like that food from my mother. I can hear any kind of music, but as the music of my people nothing can move me , I can stretch my Umwelt to the folk music, to the classical music or to any kind of music, but I'm the one who chooses it and I choose the one that suits me as if is part of me. In my training, I can tend to any profession, but only in the job that I like and make progress.

You stay one day in a library and watch how diversely is the book request; excepting the school or work obligations, the requests are as much different as the fingerprints of each individual, too.

We can live in the same house, in the same family, we can sleep in the same bed, but how differently can we be in our experiences, in our behavior, in our way of being. We can go together to the same show, to the same Pinacoteca and we see the same movie, but how differently our emotional experiences can be. But why are they different? Because each of us has his Umwelt, because each of us selects in it and for it what we like, what suits us, what fits better in the accumulations of our Umwelt. The environment we built is ours as it is the shirt for us, as it is the colour of our eyes, etc.

We can live in the same environment but we can be so different in terms of our Umwelt, so, only in this way we can realize that it is a creation of each of us, that each can realizes his own environment.

Families with many children represent a gift from God. You can not have many children if you do not love them, or better said it is a sin to have many children and not love them, without being preoccupied of their education. Although they are brothers, although they have a genetic background that comes from the same root, their genetic fingerprint is different, and their Umwelt is more different, even though some are univitelline twins. How not, if everyone chooses from the environment what suits him, what he can and how much he can, what he can accumulate for later or for his whole life.The Umwelt is my environment, it is part of me, as if I am part of it. As biological

individual, it is I with my Umwelt. Wherever I go, I go with my qualities, with my habits, with all my feelings, with my way of being and my way of manifesting. They can not be separated from my Umwelt because they form a unitary whole, as a living being it is I with my Umwelt. One can not understand by this that I can not sleep in another bed, in another house, or I can not leave my village, the country or even the continent, but wherever I go, I go with my prolongation.

In our existence, we form ourselves certain habits, certain behavioral schemes, which we have achieved in our external environment. They belong to us and characterize us. It is as if we assimilate the external environment in the internal environment. We tend to believe that in the formation of a new family the married couple besides that they like one another and love one another; they have to understand how different they are by their Umwelt. A wife does not enter in the family only with her equip married but with her Umwelt, sometimes problems can arise from here when it is too different and too reserved.

As Kinji Imanishi [12] considers, living beings can be understood only together with the environment to which they belong, together with that they evolved. It's an evolution of both living beings and the environment, a coevolution. Life appeared on Earth in an anaerobic environment, however, in its evolution it has completely changed the environment, made it aerobic. Oxygen on Earth is of photosynthetic nature. Beings act on the environment, animate it, transforming it in an extension of the self.

The Umwelt determines the assimilation of some elements from the external environment in the internal environment. Since the nineteenth century, Herbert Spencer has grasped the role of the adaptation in the transformation of the external environmental in the internal environment. But this brilliant observation appeared before time, until today ecologists, physiologists and evolutionists have come to this truth using the cybernetic principles.

In the transition from Protozoans to Metazoans it began to form an internal environment that has got very important adaptive and physiological dimensions together with evolution .If unicellular individuals are bathed in the external environment with which they realize directly changes of matter and energy, the transition to pluricellular metazoans determined the isolation of the inner cells from the direct contact with the external environment.

For the exchange of energy and substance among cells it was necessary the creation of an internal environment to bathe the body's cells. This medium consists of hemolymph in the lower organisms and of circulatory medium in the superior ones, which have a closed circulatory apparatus. In this situation, the internal medium is composed of blood, interstitial fluid and lymph, to which it is added some circulating liquids.The internal medium, has undergone an impressive morphophysiological progress in the evolution of animals reaching to a perfect homeostasis in the homothermic vertebrates (birds and mammals).

Nevertheless, we can not speak of Umwelt without making a natural connection with what we call Innenwelt, ie the internal medium But the Innenwelt does not mean just the circulating and noncirculating body humors, but endless more. The Innenwelt becomes richer depending on accumulations based on experience.

The Innenwelt is a medium selectively realized, depending on the needs, interests and the possibilities of the individual.

What is very important to understand here is the fact that at the realization both of the Umwelt and of the Innenwelt we participate with our whole being. We even if we are "**thrown away**" in an environment (no creature at birth is able to choose its parents, the geographical area or the historical period in which to live), step by step we realize ourselves with our environment, an individual environment.

The Innenwelt allows to individual to find his way in life, the way in the environment and to insert himself in a relationship of communication, interest and living that each has in common with

others of the same species and with the individuals belonging to other species.Biosemiotics demonstrates us that the systems that communicate with the outside world (open systems) and create themselves an Umwelt are systems capable of learning.Messages coming from the environment are subject to interpretation, being mediated by receptors [20].

Behavioral schemes, which the child forms them, help him in exploring the environment and in his existence. Taking into account that at birth, the human child is still not a man, but he becomes a man in the social environment through education, then we understand what it means the individual accumulations in the realization of the personality and of the individual environment. It is considered that the man is the statue that sculpts himself. Each is the result of his work; the life experience is accumulated through labor. The experience accumulated in one area or another is accumulated in Innenwelt and marks the personality of an individual for the whole life because it belongs to his human accumulations. We realize that the interaction between Umwelt and Innenwelt leads to the formation of a unitary whole.

Starting from a handful of unconditioned reflexes the child forms himself a series of conditioned reflexes and human stereotypes which will lay at the basis of the behavior. The environmental schemes ensure the conquering of the environment and they are at the basis of learning.

Learning can modify the functional parameters of any being. Learning enters in the treasury's Innenwelt. Training of reflexes and stereotypes advantages the driver in avoiding serious accidents, learning and experience accumulated allow to the individual the finding of some saving solutions in emergency cases. Accumulation of any kind (intellectual, technical, artistic, etc.). enter in the sphere of the Innenwelt and allow a better adaptation to the environment.

Adaptation contributes to the realization of what we call the organism – environment unity with the resonance in the genealogic tree of the beings. Using a modern language, based on cybernetic principles, we can speak of what rightfully George Kampis considers (1998, 2002), as being an assimilation of the environment, ie a transformation of the external environment in the internal medium. This aspect is particularly interesting because the notion of environment can not be understood any more just as a physiological characteristic of the organism, being much enlarged, It is also spoken today by an internal environment at the level of species (populations), of a biocoenosis etc. Man can not be viewed any more just as a biological being that "**bathes**" in an environment, but as a being who accumulating some elements from the environment, put his mark on it, changing it. Our reactions to environmental challenges are different, depending on the human-specific individual accumulation. In fact, intelligence and human experience accumulated appear as being components of the Innenwelt. The transformation of the external environment in the internal medium is performed differently from one individual to another depending on the structure or the treasure accumulated in the Innenwelt.

In front of the same universal masterpieces of painting our emotional experiences are much different, depending on the degree of culture of each individual.

Learning (accumulation of any area of human existence) enters in the Innenwelt's structure and allows the extension, sometimes it's unlimited. The "**beating**" or the vector of inter human relationships of a polyglot is a timeless longer than of a person who does not know any foreign language, but is forced to stand among strangers.

The voice quality is an attribute of the biology, but a perfectly pleasant and cultivated voice becomes a quality of the Innenwelt that opens the Umwelt's vector over a long distance in the direction of human interrelationships.

The environment can not be regarded as something detached from us, as something truly new from outside and independent of us , especially in the situation in which we understand the adaptation as a process of assimilation of the outside environment (in its inside).

The interiornalization can not be formulated as a process of assimilation, of learning, as physiological, ethological and ecological research proves. Pavlov's dog has interiorized the sounds of the bell as a signal for receiving food. But how many environmental signals do we not interiornalinalize ?

Biosemiotics teaches us that no living being exists that it does not emit and does not receive and processes signals.

We must accept that in the environment is launched a multitude of signals and that it works endless symbols: *"Life is just this environment of symbols that is protected and perpetuated"* believes Jacob von Uexküll (1925, 1936). In addition, we must not refer only to human, but we must descend to the simplest living beings, which is the origin of a "**self**" and of a "**subjec**t", as we have seen in amoeba and in bacteria.

Around us, it is a system of signs because life generates them by **intentionality.**

The semiotic dialogue ensures us our entire existence as biological being. The i**ntentionality** must be accepted as an adaptation strategy. Our Innenwelt assimilates signals from environment that determine then some behavioral schemes with lower or higher significance in our [7].

Applying this thinking mode even just in human, we shall understand that every human being becomes an individuality as a result of his ability to decipher and interpret more or less signals and integrate them into its environment The Umwelt contributes to the realization of an Innenwelt thus structured so as to provide the necessary feedback for the development of the Umwelt.

We read a book we like, or see a certain show, our heroes become so close that they seem to be part of our family, in our environment as if they are flesh from our flesh. We hear a beautiful melody and we like it so much that we never forget it and we would like to hear it again; it entered into the treasure of our Innenwelt.

A certain signal of the environment is interiorinalized and begins to make part from us. Environment is part of us as we are also part of the environment. However, we take from the environment only what we want, only what it is passing through our own filter. Only in this way, we are building our personal environment.

I form part of an environment, I participate in the activities of a collective, but my presence within the team is not just physical or biological, I penetrate within the collective with my Umwelt and Innenwelt. My environment determines my aura, which is part of me. I do not read the students a lecture, but I make a lecture emanating from my being, according to my understanding and my understanding is dependent on the wealth or treasure of my Innenwelt, so of my accumulations in the field as well as my physiological and mental state.

Broadening the concept of Innenwelt as internal environment we must accept that there is a particular internal environment in which the genes carry on their activity and existence, too [2].

The activity of the genes depends largely on the environment in which they act. However, what does it mean the environment for genes?

The niche of a gene is that part of the cellular and organic environment that enables its replication. The cellular environment is multidimensional depending on the constellation of genes with which each gene can establish interrelationships and on the autopoietical network of the cell. It is known the fact that a gene gets penetrance and expressiveness, is dominant or recessive depending on the genes with which it comes into contact.

The environment in which genes carry on their activity is a component part of the Innenwelt. The immune reaction of the organism depends on both the individual's constellation of genes and the environment in which the genes carry on their activity.

David Deutsch [5] believes that "*the genes incorporate knowledge about their niches: "Life means the physical embodiment of the knowledge. An entity is adapted to its niche if it captures knowledge that makes the niche to keep that knowledge in existence"*.

It is as if the genes know what to do the cell, when and how it has to act. The cell executes several commands required from the level of the organism, from the level of some organs or tissues. To believe that the cell does not know what it makes, it is a naïve understanding.To say that the genes know what to do in a cell or within the organisms is not a hazardous statement. If a cell receives an order for the synthesis of a substance (protein or enzym) then it ocurrs the activation of the respective gene, copying the information and the formation of the mRNA and the starting of the synthesis process. The order for the synthesis of the respective substance is not illusory and it does not remain uncontrolled. The order contains precise information about the quality and quantity ordered for the synthesis. If the synthesis process is underway and if we introduce into the cell a certain amount of substance that just is synthesized, we shall find that the cell knows about our intervention. It **"analyses"** the created situation and act according to the real quantity of substance that is in the respective moment stopping the synthesis process if there is enough substance or it will continue it until it is obtained the programmed amount.

Nothing is random. Deutsch's affirmation is not hazardous. It is not hazardous to think that the Universe is based on knowledge and that this knowledge (Smart) has a material in the vital structures. The knowledge enters in the treasure of the Innenwelt's accumulations. "*What I want to say* – affirms D. Deutsch [5], *is that although all known life forms are based on replicators, the phenomenon of life refers to knowledge actually*".

An organism invaded by a pathogenic agent learns immediately about the penetration of it in its interior (by the complement system, formed of 30 seric and membrane proteins) and it begins to take the necessary measures for its elimination.

After the organism realizes the knowledge of the pathogenic agent, if it was or not into contact with it, it mobilizes the active army that must phagocvtize the cells of the pathogenic agent and to eliminate them. If the fight takes place with difficulty it is mobilized the "*reserve army"*, too [21].

There are drawn to action the macrophagous cells from different tissues and put into circulation. The active defense process of the organism continues until the pathogenic agent is eliminated and a state of immunity is ensured. All these are related to what we call Innenwelt and we can affirm that they are based on knowledge.

The organism always knows the state in which is find and it acts according to the concrete situation.

We should understand that by the interrelation between Innenwelt and Umwelt is also ensured the realization of the individual environment of a being; it means creation, it means the history of existence of the respective individual in the world around

The organism of a living being governs and controls not only its own body but also its environment. The living being is the master of its own environment, moreover than that, it can build its own environment in a broader environment (wider) [22].

Language, society, education, race, gender, family, and the own genetic material, faith and our thoughts, habits and routines and all human accumulations recorded in our Innenwelt decide how we understand and how we experience ourselves and how we see the world around us and interact with it. We are so caught in our own way of being and seeing the things that we forget that our filters stained us the perspective, that we continue to project them on the world, but we believe what we see in **"outside"** is an objective reality [14 -16]. The things are much influenced by our own filters.

Perhaps they are right those who argue that the way in which we see the world is a mirror of what happens inside us. Often the problems we face in the outside world are reflections of the hot unresolved issues, which racks our thinking and marks us the self (there are problems of our inner world).

Imanishi King (1941) considers that the creatures can not exist without the environment. Their beings can not be understood only in a system that includes the environment, too, of which they

belong to, the environment being a part of the world which co-evolved with the beings. The recognition of the environment by the beings is the recognition of something necessary to their existence. And because they live in the environment, they animate it (it confers it the character of a living being) transforming it in an extension of the self.

"*Only an environment which is recognized by a creature can be considered suitable for this and for the context of its external world. In this world the being is mistress: so it must be interpreted as governing and controlling not only its own body but also the surrounding environment"* [12].

Imanishi King calles the integrated nature of the creatures, which consists in the own government and of the surrounding world as **shutaise**i [11]. The life of the living beings consists in the assimilation of the environment and in the control of the world, this meaning the inherited shutaisei.

I. Kinji does not separate man from the world of creatures and considers that the subjectivity is a feature of the creatures since its early beginnings. He sees our genesis starting on the evolution path of the living world.

It seems to him natural that, if we consider the cells as having a life of the plants, then why should it be absurd to see a cellular "mind" in cells and one of the plants in plants, even if we have to make an obvious distinction between these [18].

I. Kinji demonstrates that the living beings and the environment are not independent entities because they influence each other. Life could not appear before forming a favorable environment for life but after its appearance life shapes its environment.

I. Kinji teaches us to see what we do not want to see or not even, we think to see. He draws our attention that in schools one does not learn that, besides the constituents of nature, there is also the nature on its whole.

Therefore, we should not see the nature as a sum of objects and phenomena, as a **"bunch"** of this kind, but as something unitary, perfectly integrated, from which they belong. Nature is the whole in which **all depend on all** those existing [9, 10, 19].

The individual environment is achieved through the twinning of the external environment with the internal environment, or more complex and more subtle said, to the twinning of the Umwelt with the Innenwelt. .

Conclusions.

In the present paper we have proposed ourselves to present the individual environment as an essential ecological factor. The environment as an ecological factor has an important significance as evolutionary strategy for both species and for individual.

As Biosphere has its environment, **Ecosphere**, with which it forms a unitary whole, the biocoenosis with the biotope forms an ecosystem, and so the species has its environment in which it carries on its existence and the evolution, namely the areal. However, we must understand that there is no being, regardless of what species, Phylum or Kingdom belongs, not to have his living environment. This environment could be called **habitat**, but this term is so much used with different meanings, that it did not precisely outline its comprising sphere.

What we would like to point out in this paper is that each individual builds, by selection, an environment of its own, a proper environment, in a broader, more comprehensive environment. The individual environment is realized at the intersection of the internal environment with the external environment or, in biosemiotic terms, through the fusion of the Umwelt with the Innenwelt in the meaning given by Jacob von Uexküll.

The Innenwelt notion is more comprehensive than that of internal medium used in the Physiology of Animals and Human, that it is reduced at the circulating or non-circulating body humors, and their homeostasis. The Innenwelt includes the entire treasure, too, which the individual accumulates it in its existence by learning and by transforming of the external environment into internal one.

As the ecological niche of a species is the creation of the respective species, so the individual environment of a being is its creation.

Even the genes function in a proper ecological environment. In addition, here the principle is applied after which every biological system creates its own environment. The same gene expresses its penetrance and expressiveness, is dominant or recessive, depending on its environment that it can realize it and the relationships with other genes, which are different from one individual to another.

The unity between organism and its own life environment is so strong that today we can not imagine the biological individual than together with its life environment.

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DER EINFLUSS VON DEN ABIOTISCHEN FAKTOREN DER UMWELT AUF DAS WACHSTUM UND DIE PRODUKTIVITÄT DES EINGEFÜHRTEN SCHWARZNUSSBAUMS IN DER WALDPFLANZENGESELLSCHAFTEN DES MITTLEREN UND UNTEREN DNJESTRS

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В данной статье рассматривается один из способов повышения продуктивности лесов – интродукция ценных древесных пород. Среди лиственных пород особое место принадлежит такому интродуценту, как орех черный. Ценные биологические свойства его сочетаются с высокими лесоводственными особенностями. Взрослые деревья ореха черного отличаются прямоствольностью и отсутствием сучьев на большей части ствола. У ореха черного ценная древесина породы красного дерева. Проведенными исследованиями в Григориопольском лесхозе и Гербовецком лесничестве доказано значительное положительное влияние на рост и состояние растений ореха черного богатой, влагоемкой, оструктуренной почвы, на которой он формирует продуктивные стволы, с большим запасом ценной деловой древесины. Лучшими сопутствующими породами для ореха черного в лесных фитоценозах Среднего и Нижнего Днестра являются клен остролистный и липа мелколистная.

Eine der Weise der Steigerung der Produktivität der Waldfläche, kann die Waldeinführung werden. Ihr Ziel ist die Aufzucht der wertvollen Holzgewächse in den Waldpflanzen, außerhalb des Weichbildes ihres naturgemäßen Gebiet. In der Welt ist schon genügend große positive Erfahrung der Waldeinführung akkumuliert worden. In vielen Fällen erweisen sich die eingeführten Waldarten konkurrenzfähiger und produktiver als Urgattungen. In dieser Situation findet sich die richtig gewählteeingeführte Art ihre ökologische Nische, vervollständigt und passt sich selbst an die Faktoren der Naturumgebung für die Erreichung den besten Wuchs Kennziffern.

Unter den Laubarten gehört besondere Stelle dem Schwarznussbaum, den man erfolgreich in den meisten europäischen Ländern aufzieht. Mehr als halbhundertjährige Erfahrung der Aufzucht der Schwarznuss hat ihre hohe Produktivität gezeigt. Gegebene Art ist eine der perspektivsten Holzarten für die transnistrischen Waldpflanzengesellschaften.

Der Schwarznussbaum ist ein mächtiger, hingehöriger zu Nordamerika Baum, wo er die Höhe von 50 m und Diameter von 1,5 m erreichen kann. Die Rinde auf dem Stamm ist dunkelbraun. Zusammengesetzte Blätter 30-60 cm lang bestehen aus 13-23 länglich-eiförmigen Blättchen. Die Früchte sind kugelförmig und bis 6,5 cm im Durchmesser, essbar. Der Schwarznussbaum entwickelt das Wurzelsystem des stielförmigen Typs, das bis zu einer Tiefe von 8-10 m dringt. Er, wie die anderen Arten dieser Familie, scheidet Phytonzide, Gerbstoffe, darunter Juglon als Antibiotikum aus [13].

Seine wertvollen Eigenschaften verbinden sich mit den hohen waldbaulichen Besonderheiten. Die erwachsenen Schwarznussbäume zeichnen sich durch die gerade stehende Struktur und Fehlen der Verzweigung an den meisten Fällen eines Baumstammes. Einzeln stehende Exemplare haben kräftig entwickelte, durchsichtige, breitabgerundete und niedrig abgesenkte Krone, die Bäume in der Anpflanzung haben längliche Krone [7].

Von uns wurden biologische, ökologische und pflanzengesellschaftlichen Besonderheiten des Schwarznussbaums in verschiedenen Typen der Waldpflanzengesellschaften des Mittleren und Niedrigen Dnjestrs erforscht. Im Laufe der Erforschung wurde bemerkt, dass die Schwarznuss: winterhaerter, lichtlieber, dürrebeständiger, wählerischer zur Bodenfruchtbarkeit ist, dabei auch schneller wächst als die Walnuss. Sie ist langlebig, resistent gegen Schädlinge und Krankheiten. Holz ist schokoladenbraun, fest, haltbar, gehört zu den wertesten Holzen des Roten Baums. Das Schwarzbaumnussholz wird fuer die Herstellung der Musikinstrumente, der Gewehrkolben, der preiswerten Möbelarten, für die Ausstattung des Raums benutzt [9].

I.F. Anten bemerkten, dass die Schwarznuss in der Zone des natürlichen Verbreitungsgebiets empfindlich zu den Bodenbedingungen ist und sich besser in dem tiefen, fruchtbaren und feuchten, fast neutralen Boden entwickelt. Innerhalb des natürlichen Verbreitungsgebiets erreicht sie die maximale Größe entlang der Flüsse und Bäche [2].

Die meisten Forscher finden, dass der Schwarznussbaum den besten Wachstum und ihre Holzproduktivität auf den tiefengründigen, genügend feuchten Böden und auch auf den leistungsfähigenalluvialen Schwarzerden und grauen Waldboden erreicht [1, 3, 12, 14].

Nach den Angaben der in Ukraine und Moldawien verbrachten Forschungen, muss man Weißbuche, Spitzblattahorn, Kleinblattlindenbaum, Waldapfel, und aus den Gebüschen - Kornelkirsche, Hasel, Schneeball zu besten Begleitarten in den Waldkulturen mit dem Schwarznussbaumzurechnen [5, 10].

Das Forschungsziel: die Untersuchung der Wirkung von den Begleitbaumarten und unterschiedlichen Bodenbedingungen auf das Wachstum und die Produktivität des eingeführten Schwarznussbaums in verschiedenen Arten von den Waldpflanzengesellschaften.

Materialien und Methoden. Die Forschungen wurden mit der Benutzung der Feld- und Labormethode erfüllt. Dabei wurde Programm und Methode der Selektion der Untersuchung der Nusskulturarten benutzt. In den experimentellen Plantagen wurden die Höhe bis zur lebendigen Krone und bis zu den Wipfeln der Bäume, Diameter der Stämme der Länge nach und querüber der Reihen in der Brusthöhe des durchschnittlichen Mannes (1,3 m), Diameter der Krone gemessen [4]. Die Höhe haben wir mit dem Höhenmesser - Waldwinkelmesser (HWW-1), den Durchmesser mit der walddimensionalen Gabel gemessen. Basierend auf diesen Daten wurden von uns die mittleren Durchmessern und die Höhe der Stämme, die durchschnittlichen Kronendurchmessern, gesamten Holzvorrat berechnet. Die Hauptzifferdaten wurden durch Analyse der Varianz mit einem Computer verarbeitet [11].

Die Forschungen nach der Untersuchung der Einfluss der Bodenbedingungen auf das Wachstum und den Zustand des Schwarznussbaums wurden in den Waldpflanzengesellschaften des Mittleren und Unteren Dnjestrs verbracht.

Die Forschungsergebnisse: Die Forschungen nach gegebener Richtung werden auf der Stationären in der Herbovezförsterei – der Bezirk der sehr trockenen Eiche – und in Grigoriopoler Forstwirtschaft – der Bezirk der Federgrassteppen und der Tieflandvegetation, nach Heidemann T.S. gemacht [6].

Gemäß dentaxationalen Angaben waren der Anpflanzungsalter und die Wetterklimatische Bedingungen des Wachstums in der Herbovezförsterei und Grigoriopoler Forstwirtschaft gleich, aber das Wachstum und der Zustand der Anpflanzungen unterschieden sich voneinander bedeutend.

Der Boden in Grigoriopoler Forstwirtschaft wurde als dünnecarbonate Tonerde mit den Merkmalen der Vergleyung bestimmt, der Boden in dem Herbovezwald wurde als Xerophyt-Forstschwarzerde bestimmt. Die Bodeneigenschaften in Grigoriopoler Forstwirtschaft geben bedeutend den Bodeneigenschaften im Herbovezwaldnach. Die Pflanzen auf gegebenen Grundstücken unterscheiden sich auch bedeutend nach ihrem Wachstum und Zustand [8].

Nach den Angaben der verbrachten Bodenforschungen kann man bemerken, dass der Boden in Herbovezforstwirtschaft nach der Inhalt von Stickstoff, Phosphor, Kalium, Humus reicher als der Boden in Grigoriopoler Forstwirtschaft ist, Tabelle 1.

Die Pflanzen des Schwarznussbaums, der in Herbovezforstwirtschaft wächst, haben kräftige und große nach dem Diameter – 16,9 cm und hohe – 17,5 m- Stämme, gut entwickelte Krone – 1,9 m in Diameter. Es gibt keine Beschädigungen von den Frühfrösten. Der untere Zweig bei den Schwarznussbaeumen auf gegebenem Grundstück, befindet sich auf der Höhe 5,5-6 m. Die Nutzholzstämme in Herbovezforstwirtschaft betragen 98,2 %, was zweimal mehr als in Grigoriopoler Forstwirtschaft, tabelle 2.

Tabelle 1

Charakteristik der Boden unter dem Schwarznussbaum in Grigoriopoler und Herbovezforstwirtschaften

Datum der Probeauswahl	Bodenschicht, m	Mg/Kg des trockenen Bodens				Humus %	$CaCo_3$	Dichter Rest, %	pH
		NO_2	P_2O_5	K_2O	NSP				
Grigoriopoler Försterei									
24.08.09	0-20	10	7	105	85	2,9	4,4	0,09	8,6
	20-40	4	5	94	6	0,5	6,6	0,05	8,9
	40-60	4	4	71	0	0,3	7,1	0,05	9,0
	60-80	4	0	64	0	0,4	7,3	0,05	9,0
	80-100	4	0	72	0	0,5	7,5	0,09	9,0
Herbowezförsterei									
25.09.09	0-20	17	22	295	105	4,0	0,6	0,07	8,3
	20-40	7	12	111	104	4,4	0,2	0,06	8,3
	40-60	4	10	121	9	2,8	0,5	0,05	7,9
	60-80	4	9	124	4	1,9	0,4	0,02	7,7
	80-100	4	11	111	4	1,5	2,3	0,02	8,5

Die Pflanzen des Schwarznussbaums, der in Grigoriopoler Forstwirtschaft wächst, haben kleinere Stämme nach dem Diameter – 7,5 cm – und hohe von – 12,1 m – haben kleinere große in dem Diameter – 1,2 m - und viele durchbrochene Kronen. Auf dem meisten Teilen von Bäumen, die hier auf dem Abhang wachsen, sind die Beschädigungen von den Spätfrühlingsfrühfrösten bemerkbar. Der untere Zweig bei den Pflanzen auf gegebenem Grundstück befindet sich auf der Höhe 2,5-3 m. Die Nutzholzstämme haben insgesamt 43,5 %.

Tabelle 2

Wachstum und Zustand des Schwarznussbaums in Grigoriopoler Forstwirtschaft und Herbovezförsterei

Forschungs-ort, Bodenquelle	Alter, Jahre alt	Mittlere Höhe des Stamms, m		Mittlerer Diameter des Stamms, cm		Mittlerer Diameter der Krone, m	Stammguelle, %			Gemein-samer Holzvor-rat m^3/ha
		$\overline{X} \pm m$	C, %	$\overline{X} \pm m$	C, %		Nutzholz-stämme	Halbnutz-holzstämme	Holzstämme	
Herbovez-försterei (Xerophyt-Forst-schwarz-erde)	30	17,5±0,5	6,2	16,9±0,3	19,0	1,9	98,2	1,8	-	144,7
Grigoriopo-ler Forstwirt-schaft (dünne carbonate Tonerde)	30	12,1±0,8	17,1	7,5±0,3	12,8	1,2	43,5	32,9	3,6	38,9

Nach den Angaben der Messungen ist mittlerer Diameter des Stamms vom Schwarznussbaum in Herbovezförsterei ist um zweieinhalbmal mehr als in Grigoriopoler Forstwirtschaft, gemeinsamer Holzvorrat ist ungefähr um dreieinhalbmal mehr. Trotz des gleichen Alters unterschieden sich die

Pflanzen auf gegebenen Grundstücken, nach ihrem Wachstum und Zustand, wesentlich. Die oben genannte Unterschiede sind mit dem starken Einfluss der Bodenbedingungen auf das Wachstum und die Pflanzenentwicklung gegebener Holzart zu erklären.

Schlussfolgerungen

Bedeutenden positiven Einfluss auf das Wachstum und den Zustand der Pflanzen des eingeführten Schwarznussbaums macht reicher, feuchter, struktureller Boden, auf dem er produktive Stämme mit großem Vorrat des Nutzholzes formiert.

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ECOLOGICAL DETAILS OF FORMING CONVERGENT COROLLA PAINTING

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The areal and temporal diversity of corolla painting in flowering plants was studied. One hundred and seventy five (175) species of the flora of Chisinau city were involved, and 317 species of herbaceous plants of Moldova were analyzed using literature sources. At flowering plants of C layer the seasonal convergence of corolla color was established. The conclusion deduced is that quantitative and qualitative parameters of solar spectrum are the limiting factor in the evolution of corolla color.

Key words: corolla, solar spectrum, convergence, herbaceous plants, color, pigments.

Introduction. In the course of plant evolution the corolla (i.e. internal part of double perianth) evolved from transformed stamens lost anthers or from top leaves. It is still not entirely clear what the biological significance corolla painting is, why different species have different paintings, does it make sense adaptive, and if so, what. The most consistent with corolla functional load is the theory of appearance of different pigments as a result of plant adaptation to solar radiation [Hormaetxe et al 2005, Solovcenco, Merzlyac 2008, Luu et al 2013]. We hypothesized that seasonal changes in the spectrum of solar radiation should lead to a convergence in corolla painting of flowering plants. For this purpose we studied the territorial and temporal variability of corolla painting in flowering plants of Chisinau.

Material and Method. The main object of the study (2005-2009 year) was the plant cover of C layer in Chisinau. The species of plants were determined at the Department of Botany, Ecology and Forestry of the Chisinau State University. Flowering periods were established by four sources (Negru 2005, 2006, 2007; Ciocârlan 2000; Geideman 1986; Asseeva & Tikhomirov 1964). Vegetation relevés of stationary plots was carried out according to the classical method of Rabotnov (1987). Photometric characteristics of the solar spectrum are given by Rvachev (1966) on the first day of each month. The statistical analysis was made according to standard algorithms within "Excel" program range.

Results and discussion. Evaluation of gamma diversity in C layer of urban flora showed the presence of 175 species of herbaceous plants from 42 families. The next 5 families are the most widely represented: Asteraceae (37 species), Poaceae (19 species), Fabaceae (14 species), Brassicaceae (11 species), Lamiaceae (8 species). Visual analysis of the corolla painting showed the presence of four color groups: blue (violet, indigo, blue, 13 species), white (white, cream, 34 species), yellow-orange (41 species), red (red, rose, purple, 34 species) (Table 1). Another group is not represented in the Table 1: with reduced corolla and/or with difficult color classification (53 species). For each color group the first month of flowering is given by mentioned above sources [Negru 2005, 2006, 2007; Ciocârlan 2000; Geideman 1986; Asseeva & Tikhomirov 1964].

Table 1

Distribution of flowering plants of C layer for flowering time and color of corolla

Species	Source				Species	Source			
	1	2	3	4		1	2	3	4
Blue, indigo, violet									
Cicorium intubus L.	5	7	5	6	*Myosotis arvensis L. (Hill.)*	5	4	5	-
Lactuca tatarica (L.) C.A.Mey	5	5	5	-	*Linum austriacum L.*	6	5	4	-
Veronica chamaedrrys L.	4	4	5	5	*Anagallis foemina Mill.*	4	5	5	-
Veronica spicata L.	6	-	5	-	*Vinca minor L.*	4	4	5	-
Ajuga genevensis L.	5	5	6	-	*Viola mirabilis L.*	4	6	4	-
Glechoma hederaceae L.	4	4	4	4	*Viola odorata L.*	5	3	4	-
Echium vulgare L.	6	5	5	6					

White									
Achillea milefolium L.	6	-	-	6	*Bryonia alba L.*	6	6	5	-
Erigeron annuus (L.) Pers.	7	-	5	-	*Papaver dubium L*	5	5	4	5
Conyza canadensis L	6	6	6	6	*Galium aparine L*	5	-	5	-
Tripleurospermum inodorum (L.) Sch.Bip.	6	-	5	4	*Armoracia rusticana Gaerth.,Mey et Scherb*	5	5	6	-
Capsella bursa – pastoris (L.), Medik	4	-	4	4	*Silene moldavica (Klok.) Šourková*	5	-	6	-
Centaurea difussa Lam.	6	-	6	-	*Crambe tatarica Sebeok.*	4	5	4	-
Chamomilla recutita (L.) Rauschert	5	4	5	-	*Galinsoga parviflora Cav.*	6	-	7	-
Alliaria petiolata (Bieb) Cavara et Grande	4	5	5	-	*Arabidopsis thaliana (L.) Heynh.*	4	-	4	-
Datura stramonium L.	6	6	6	-	*Berteroa incana (L.)DC*	5	5	5	5
Connvalaria maialis L.	5	4	4	5	*Lepidium draba (L.) Desv.*	5	5	4	-
Daucus carota L.	6	5	5	-	*Melilotus albus Medik.*	6	-	6	6
Fallopia convolvulus (L.) A.Löve	6	-	5	-	*Trifolium montanum L.*	5	-	5	5
Heracleum sibiricum L.	6	6	6	6	*Stellaria media (L.)Vill.*	3	5	3	4
Anthriscus sylvestris (L) Hoffm.	5	5	6	5	*Saponaria officinalis L.*	6	-	6	6
Convolvulus arvense L.	5	5	5	6	*Solanum nigrum L.*	6	6	6	6
Calystegia sepium (L.) R. Br.	6	5	6	7	*Caucalis platycarpos L.*	5	-	6	-
Crepis pannonica (Jacg.) C.Koch	7	-	6	-	*Conium maculatum L.*	6	6	5	-
Yellow									
Taraxacum officinalis Wigg.	4	4	4	4	*Galium verum Echtes Labkraut*	6	6	5	-
Sonchus arvensis L.	7	-	6	7	*Ranunculus acris L.*	5	-	5	-
Sonchus palustris L.	7	-	6	-	*Ranunculus oxispermus Willd.*	5	-	5	-
Inula germanica L.	7	6	5	-	*Sisymbrium altissimum L.*	5	-	6	-
Senecio vulgaris L.	6	-	4	5	*Sinapis arvensis L.*	5	5	6	6
Portulaca oleracea L.	6	6	5	-	*Potentilla erecta L.*	5	-	-	5
Hypericum perforatum L.	6	5	5	6	*Potentilla reptans L.*	6	5	5	-
Hypericum hirsutum L.	6	-	7	-	*Geum urbanum L.*	*5*	*5*	*5*	*6*
Rezeda lutea L.	5	-	5	-	*Potentilla anserina L.*	*5*	*5*	*5*	*5*
Chelidonium majus L.	5	5	5	5	*Agrimonia eupatoria L.*	*6*	*7*	*6*	*6*
Grindelia sqarrosa (Purch) Dun	7	7	7	-	*Rorippa austriaca (Crantz.)Bess*	*6*	*5*	*5*	-
Tanacetum vulgare L	7	6	6	6	*Euphorbia agraria Bieb.*	*7*	*5*	*4*	-
Crepis foetida L.,var.rhoeadifolia (Bieb.)Čelak	6	-	6	-	*Euphorbia peplus L.*	6	-	7	-
Crepis pannonica (Jacg.) C. Koch	7	-	6	-	*Euphorbia palustris L*	5	-	5	-
Tragopogon dubius Scop.	5	5	5	-	*Medicago romanica Prod.*	5	-	6	-
Scabiosa ucranica L.	6	-	6	-	*Medicago lupulina L.*	5	5	5	6
Asparagus officinalis L.	6	6	6	5	*Medicago minima (L.) Bartalini*	4	-	4	-
Verbascum nigrum L.	6	6	6	6	*Melilotus officinalis L. (Pall.)*	6	6	5	6
Linaria vulgaris Mill.	6	6	6	6	*Lotus corniculatus L.*	5	5	5	6
Sideritis comosa (Rochel ex.Benth) Stank	5	-	5	-	*Astragallus glycyphyllos L.*	5	5	5	6

Anchusa ochroleuca Schost.	5	-	-	-	*Potentilla argentea L.*	6	6	5	5
Red, rose, purple									
Salvia nemorosa L.	6	6	6	-	*Urtica dioica L.*	6	6	6	6
Ballota nigra L.	6	5	5	-	*Fumaria officinalis L.*	5	4	5	6
Geranium robertianum L.	5	5	5	-	*Lythrum salicaria L.*	6	7	6	6
Vicia craca L.	6	-	5	6	*Lavatera thuringiaca L.*	6	7	6	6
Mentha piperita L.	6	-	7	-	*Hibiscus trionum L.*	6	-	6	-
Campanula persicifolia L.	6	6	6	6	*Althaea officinalis L.*	7	-	6	-
Solanum dulcamara L.	6	5	5	6	*Consolida regalis S.F. Gray*	4	6	5	-
Cardus acanthoides L.	6	-	6	-	*Trifolium pratense L.*	5	6	6	6
Cardus nutans L.	6	-	6	6	*Trifolium fragiferum L.*	6	5	5	-
Cardus hamulosus Ehrh.	6	5	5	-	*Vicia angustifolia Reichard*	5	-	5	-
Arctium lappa L.	7	-	6	-	*Lathirus tuberosus L.*	6	5	6	-
Cyrsium palustre (L.) Scop	7	-	6	-	*Coronilla varia L.*	6	-	6	6
Cyrsium arvense (L.) Scop	7	-	6	-	*Polygonum aviculare L.*	6	5	5	6
Leonurus cardiaca L.	6	-	7	7	*Polygonum hidropiper L.*	7	-	6	6
Xeranthemum annuum L.	7	6	6	-	*Polygonum persicaris L.*	7	7	7	-
Onopordum acanthium L.	7	-	6	-	*Rumex conglomerates Murray*	7	-	6	-
Allium rotundum L.	6	7	7	7	*Centaurea pseudomaculosa*	6	-	6	-
Lamium purpureum L.	3	-	4	4	*Dobrokz.*				

Comments: 1 – Negru (2005, 2006, 2007); 2 – Ciocărlan (2000); 3 - Geideman (1986); 4 – Asseeva, Tikhomirov (1964).

The value of mean month (Table 2) is the average (of the different sources mentioned in the table) number of month in which flowering begins. Table 2 shows that plants with blue flowers tend to begin flowering earlier than plants with white, yellow and red flowers. The average value of this parameter for purple flowers is higher than for the other color groups. We decided to check whether the pattern found in the flora of Chisinau is reproduced for the flora of the whole Moldova.

For this aim, the random sample of herbaceous plants from Negru (2005, 2006, 2007) was analyzed. Table 2 shows that both red and blue color groups significantly at level $p < 0.001$ different from the other color groups. As for the yellow and white color groups, between them there are no significant differences. Compared with the central (yellow-white) group the blue group shows a flowering shift 1.2 month, and the red group shows a shift +1.8 month. Thus, we can conclude that characteristic colors of early flower are blue and violet. For plants beginning to bloom on average in late June, the characteristic color of corolla are red, rose and purple. Therefore, with great certainty, we can argue a seasonal convergence of corolla color in herbaceous plants.

Table 2.

Beginning flowering of herbaceous species in different color group

Flora of Chisinau city								
Number of month	Blue group		White group		Yellow-orange group		Red group	
	number of species	%	number of species	%	number of species	%	number of species	%
3	1	33.3	1	33.3			1	33.3
4	6	31.6	8	42.1	4	21.1	1	5.2
5	5	9.4	13	24.5	25	47.2	10	18.9

6	1	2.3	10	22.7	12	27.3	21	47.7
7							1	100.0
∑	13		32		41		34	
Mean month	4.46 ±0.22		5.00±0.15		5.20±0.09		5.59±0.13	
Random sample from flora of Moldova								
2			2	100				
3	10	50	3	15	7	35		
4	17	43.6	14	35.9	8	20.5		
5	28	22.2	38	30.2	46	36.5	14	11.1
6			37	32.2	36	31.3	42	36.5
7					11	73.3	4	26.7
∑	55		94		108		60	
Mean month	4.327±0.104		5.117± 0.095		5.370± 0.097		5.83± 0.068	

Comments: Integer value of "mean month" corresponds to middle of the month. For example, 5.0 =May 15, 5.5 = May 31 etc.

Considering the absorption of light by corolla in different color groups, if absorbent pigment is unknown we can approximately determine the absorption band from the table of complementary colors (Table 3). When the visible diapason is reflected totally, we observe white corolla. If one of colors is excluded from the total spectrum (in our case, absorbed by pigment-acceptor), the sum of remaining reflected colors will be perceived as a certain color called complementary to the excluded color [Gurevich 1950]. Based on Table 3, for the blue color group should be expected light absorption in yellow and orange diapasons, for the yellow-orange group - in blue one, for the red group - in green one. This table gives an approximate solution, since it is assumes the ideal case when the absorption spectrum is stepped and lies within one of the traditional colors. Therefore, if we know the nature of the pigment, it is better to use the data on its real absorption spectrum.

Table 3

Complementary colors, λ (nm)

Excluded color	Red 780-630	Orange 630-600	Yellow 600-570	Green 570-490	Blue 490-460	Indigo 460-430	Violet 430-380
Complementary color	Blue-green 430-570	Indigo 460-430	Violet 430-380	Purple 380+780*	Orange 630-600	Yellow 600-570	Yellow-green 600-490

Comments: * This color is combined by extreme shades of spectrum.

Table 4 provides information about the known classes of pigments that are found in the corollas of flowers. Chlorophylls are not included because the green color group we had a small and therefore not included in the analysis.

Table 4

Pigments causing color of corolla

Pigment class	Visible color	Peak or zone of absorption	Distribution and examples
1. Carotenoids	Yellow	425-500 (blue, indigo)	*Taraxacum, Narcissus*
2. Phenol compounds			
2.1. Quinones		UV, the batochrome shift to blue area is possible	
2.1.1. Chalcones	Yellow	360-425 (UV, violet)	*Antirrhinum*
2.1.2. Aurones	Orange, red	450-550 (blue, green)	*Rarely* (safflower)
2.2. Flavonoids			

2.2.1. Anthocyanines			Almost all red, blue and red-blue flowers, the most of orange ones
	Orange	480 (450-510), blue	
	Red	510 (blue-green)	
	Purple	460-540 (green)	
	Blue	500-640 (green, yellow, orange) – as result of intermolecular copigmentation or batochrome shift	
2.2.2. Flavones, flavonoles			
	White, cream	UV	
	Yellow	350-425 (UV, violet)	
3. Betalaines			Particular families
3.1. Betaxantines	Yellow	480 (blue)	
3.2. Betacyanines	Red-violet	534-554 (green)	

As the Table 4 shows, in the blue group the painting is caused by anthocyanins exclusively (with the possible intermolecular copigmentation with flavonols) at the absorption in broad band from green to orange inclusively. In the yellow-orange group the coloration may be caused by different pigments (carotenoids, quinones, anthocyanins, flavonoids, betaxantin), but in all cases the absorption takes place in the short-wave part of the spectrum (blue, indigo, violet) extending sometimes into the ultraviolet. In the red group the painting is caused mainly by anthocyanins and sometimes by aurone and betacyianin. The absorption zone in this case is green or blue-green. Pigments of the white group are flavonoids, which absorb in the ultraviolet. Thus, the true absorption spectrum roughly corresponds to that which can be derived by the additional colors. The most significant correction is that in blue color group the absorption band is not limited by yellow-orange area, but includes the green area too.

In the study of photochemical reactions caused by natural radiation in plants is of interest to the spectral distribution of the photons in the solar radiation. In the upper part of the Earth's atmosphere the most numerous photons are yellow with wavelength 560-590 nm. With the passage of sunlight through the upper atmosphere, the number of photons decreases gradually towards longer wavelengths and steeply toward short one: water vapor absorbs infrared radiation in several bands longer than 700 nm, oxygen has a number of narrow absorption lines near 687 and 761 nm, ozone strongly absorbs in the ultraviolet and visible regions of the spectrum, due to which the peak photon density is shifted from yellow to red (about 685 nm to). Plants are adapted to this spectrum, which is mainly determined by the oxygen supplied to the atmosphere by the plants themselves.

Irradiance produced by the solar radiation on the earth's surface, is determined by the height of the Sun above the horizon and, therefore, depends on the latitude, the time of year and time of day (Table 5). Moreover, this value is strongly dependent upon a number of meteorological factors, such as clouds, humidity and atmospheric transmittance. Seasonal reduction of solar radiation in the atmosphere is expressed by the Bouguer law:

$$E = E_0 \cdot R^{Tm},$$

where *E* is irradiance at the surface of the Earth produced by sunlight passing through a layer of *m* optical mass, E_0 is trans-atmospheric irradiance or solar constant, *R* is factor of atmospheric transparency, *T* is haze ratio.

R and *T* are different for different wavelengths of the solar spectrum and increasing beginning winter towards summer. Reducing the solar height, the mass of air, penetrated by the beam with a single cross-section, increases in proportion to the length of the path traversed by the beam in the

atmosphere [Rvachev 1966]. So, the spectral composition, the peak position and short-wave limit of solar radiation on the Earth's surface are determined by the height of the Sun above the horizon. The lower the sun goes down, the richer spectrum of long-wavelength (red-orange) radiation and short-wavelength (violet-blue) boundary and the emission maximum shifts to longer wavelengths. Thus, from April to June, there is a rise of the sun over the horizon and the associated shift blue/red ratio (Table 5). In the same period, there is a shift in the color of the flowers: flowering species with blue, indigo and violet corolla (average start in April) is replaced by species with a red corolla (average start in June). We can assume some adaptive sense that corolla pigments absorb light in a certain range of the solar spectrum, and that this adaptation is often realized in the course of phylogeny, which is visually manifested in the observed seasonal changes of color distribution.

Table 5

Seasonal shift of parameters of solar spectrum at the latitude 47˚ (Chisinau)

	Parameters of solar spectrum								
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
March	41	1.55	560	400	11.5	12.2	18.7	12.8	0.953
April	53	1.30	660	480	13.0	12.9	18.9	12.1	1.066
May	62	1.15	770	560	14.5	13.2	19.0	12.0	1.100
June	66	1.06	805	640	16.0	13.4	19.0	11.9	1.126

Comments: 1 – month; 2 – height of the sun above the horizon at midday; 3 – lens mass; 4 – average irradiance of a horizontal surface W/m^2; 5 – a daily dose of physiologically active radiation, W·sec; 6 – duration of day, hours; 7 – relative intensity of violet-blue band (380-490 nm), %; 8 – relative intensity of green-yellow band (490-600 nm), %; 9 – relative intensity of the orange-red band (600-780 nm), %; 10 – the ratio of the intensity violet-blue/orange-red.

The seasonal shift of the peak of solar radiation reaching the earth is consistent with our hypothesis.

Violet-blue tones of corolla are caused by the absorption of photons of yellow-green range. Preferential absorption of these photons is probably due to their relatively large part in the integer solar spectrum in the spring time. However, as in the case of photosynthetic the energy absorbed is utilized to create energetic equivalents (ATP and NADP*H) for assimilation of CO_2, in corolla CO_2 is not assimilated, energy equivalents is not formed, and the absorbed energy is channeled by the two circuits: the energy dissipation into the heat form and fluorescence. Hence, the temperature of corolla and reproductive organs (stamens and pistils) increases, which creates better conditions for the fertilization. Since most pollinators is partial or complete colorblind, their unmistakable recognition of flowers may be due to a slightly elevated temperature of the flower and the emanation of odors, which also increases with a higher temperature. The appearance of flowers of white, orange, yellow, yellow-green and white color coincides with an increase in the density of photons of blue-violet and ultraviolet range in the solar spectrum from April to June months (Table 5). The pigments responsible for this coloration absorb high-energy blue-violet and even ultraviolet photons. Absorbed energy is dissipated into heat and contributes to a more vigorous evaporation of water. Increased evaporation causes the decrease in temperature of flower in the hottest period and protects reproductive organs of plants from heat stress [Smolikova, Medvedev 2015]. Leaves have the similar mechanism too. Leaf temperature is always lower than the air temperature in the hot. Finally, red and purple flowers appear which have the pigments absorbing green range (570-490 nm) of the visible spectrum. It may be associated with an increase in the intensity of green light reflected by tree layer A. This illustrates the adaptability of plants to use solar energy, obtained in the course of their evolution on the ground.

Conclusions.

1. For the herbaceous flora of Moldova the seasonal differences between the types of corolla color are established. The species with a red corolla is characterized by a relatively late flowering, the species with a blue, indigo and purple corolla – relatively earlier.

2. Seasonal changes of corolla color correspond to seasonal changes of solar radiation reaching the earth's surface, providing probably the best conditions for the reproductive organs of flower.

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ABOUT EVOLUTION OF COROLLA COLOR IN FLOWERING PLANTS

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The assumption about the connection of species evolutionary advancement with the flowering period and corolla anthocyanin and white coloring was checked on 85 species of concrete flora of the city of Chisinau and 147 species of potential flora of Moldova. It was established that with flowering period increase the families evolutionary advancement increases, the proportion of species with white and violet-blue corolla decreases, while the proportion of species with rose-purple corolla increases.

Key words: corolla, anthocyanin coloring, white coloring, evolutionary advancement, flowering periods.

Introduction Angiosperms exhibit a tremendous diversity of flower colors, with sister species often differing in the intensity, hue, or patterning of the corolla. This diversity implies that there have been numerous evolutionary transitions in flower color, Rausher, [2008].

While studying the demographical situation of flowering plants, Illichevsky [1938] has paid attention that "the general way of flowering in flora in main features repeats the history of its development: at the beginning of the vegetation period the primitive types of flowers (flowers with superior ovary, with two rounds of androecium) dominate; at the end of summer higher types get sharply prevail, such as the flowers with inferior ovary, sympetalous ones, those with one round of stamen, etc. intensively bloom; as well as flora "creation wreath" – the most highly organized thistle family – absolutely dominates at the end of summer".

There are similar reasonings about the correspondence of flower coloring and species evolutionary advancement in works of Blagoveschensky [1966]. The author compares various anthocyanin colorings of flowering plants corolla between themselves, that are caused by delphinidine, cyanidine and pelargonidine, of which the first is considered as more evolutionally advanced pigment.

For Moscow region flora Nasimovich [1993] has stated, that the more evolutionally advanced the family is, the less white-flower species it includes. For example, in Moscow region white-flower species make: in Caryophylláceae family 74 percent; in Rosaceae family 51 per cent. There are many of them (from 33 to 16 per cent) in Brassicaceae, Liliáceae, Orchidáceae, Ranunculáceae, Fabáceae, families too. But in such families as Geraniáceae, Boragináceae, Campanuláceae wild-growing white-flower species are completely absent. There are few of them (from 10 to 15 per cent) in families of Scrophulariáceae, Violáceae, Lamiáceae, Asteráceae families. Thus, white flowers are more typical for the species, that are less evolutionally advanced.

Three main classes of anthocyanin pigments of the angiospermous plants (pelargonidine, cyanidine and delphinidine) differ first of all in the number of hydroxyl groups in a beta-ring: pelargonidines have the largest number, cyanidines have one hydroxyl group more while delphinidines even one hydroxyl group more [Britton, 1980; Andersen, Jordheim, 2006]. Depending on different endogenic and exogenous factors, delphinidine anthocyanins tend to be violet, blue or purple, cyanidine ones become blue, purple-red or red, while pelargonidine ones almost always are red or orange. Rausher, [2008] established, that evolutionary transitions from colored corolla to white-flower ones are connected with the loss of function mutations, while the transitions from blue-violet to red-orange colors are caused by the anthocyanin synthesis switch from more hydroxylated to less hydroxylated.Thus, if flora phylogenesis is repeated in the phytocenosis ontogenesis, so the evolutionary transitions between the plants qualitative characteristics have to be repeated, in particular the evolutionary transitions between the flowering plants anthocyanin corolla coloring. The aim of the presented paper is to verify this assumption.

Material and method The main object of the study (2005-2014) was the plant cover of C layer in Chisinau. The species of plants were determined at the Department of Botany, Ecology and Forestry of the Chisinau State University. Flowering periods were established by four sources (Negru, 2005, 2006, 2007; Ciocarian, 2000; Geideman, 1986; Asseeva & Tikhomirov, 1964). Releves of stationary plots was carried out according to the classical method of Rabotnov (1966). Corolla coloring was evaluated basing on six-point scale, where 1 is light blue, 2 – blue, 3 – violet, 4 – rose, 5 – crimson, 6 – purple. In the tables white corolla color is marked by "0", and corollas of yellow shades were designated by the letter "y" and were not taken into consideration during the analysis.

Evaluation of corolla coloring (six-point scale)

					
Myosotis arvensis L. (Hill.)	***Anagallis foemina Mill.***	***Viola odorata L.***	***Lavatera thuringiaca L.***	***Lathyrus tuberosus L.***	***Arctium lappa L.***
1	**2**	**3**	**4**	**5**	**6**

The statistical analysis was made according to standard algorithms within "Excel" program range.

Results and discussion The evaluation of gamma diversity of concrete C layer flora of Chisinau demonstrated the presence of 178 species of herbaceous plants from 42 families. The most widely represented are five of them: Asteraceae (37 species), Poaceae (19 species), Fabaceae (16 species), Brassicaceae (11 species), Lamiaceae (8 species). The visual analysis of corolla coloring in this sample has shown four color groups: violet-blue (13 species), white (34 species), yellow-orange (41 species), purple-rose (34 species) and the groups with reduced corolla and/or corolla with coloring that was difficult to determinate (53 species). In this paper we analyze the species with supposed anthocyanin corolla coloring (light blue, blue, violet, rose, crimson, purple), as well as the group of white-flower plants (Table 1)

Table 1

Concrete C level flora of Chisinau with anthocyanin and whit corolla color.

N	Species	T	C	F	N	Species	T	C	F
1	*Consolida regalis S. F. Gray*	1	3	5,0	44	*Conium maculatum L.*	15	0	5,5
2	*Papaver dubium L.*	2	0	4,7	45	*Bryonia alba L.*	16	0	5,5
3	*Fumaria officinalis L.*	3	3	5,0	46	*Galium aparine L.*	17	0	5,0
4	*Silene moldavica(Klok.) Sourkova*	4	0	5,2	47	*Vinca minor L.*	18	2	4,7
5	*Stellaria media (L.) Vill.*	4	0	3,7	48	*Convolvulus arvense L.*	19	0	5,2
6	*Saponaria officinalis L.*	4	0	6,0	49	*Calystegia sepium (L.)R.Br.*	19	0	5,7
7	*Anagallis foemina Mill*	5	2	4,5	50	*Echium vulgare L.*	20	2	5,5
8	*Viola mirabilis L.*	6	1	4,5	51	*Miosotys arvensis L.(Hill.)*	20	1	4,5
9	*Viola odorata L.*	6	3	4,7	52	*Veronica chamaedris L.*	21	2	4,5
10	*Capsella bursa pastoris (L) Medik*	7	0	4,0	53	*Veronica spicata L.*	21	3	5,5
11	*Alliaria petiolata Cavara et Crande*	7	0	4,5	54	*Ajuga genevensis L.*	22	2	4,0
12	*Crambe tatarica Sebeok.*	7	0	4,5	55	*Glechoma hederaceae L.*	22	2	4,0
13	*Arabidopsis thaliana (L.) Heynh.*	7	0	4,0	56	*Salvia nemorosa L.*	22	3	6,0
14	*Berteroa incana (L.) DC*	7	0	5,0	57	*Ballota nigra L.*	22	5	5,5
15	*Lepidium draba (L.)Desv.*	7	0	4,5	58	*Mentha piperita*	22	4	6,5
16	*Armoracea rusticana **	7	0	5,5	59	*Leonorus cardiaca L.*	22	0	6,5
17	*Lavatera thuringiaca L.*	8	4	6,2	60	*Lamium purpureum L.*	22	6	3,7
18	*Althea officinalis L.*	8	0	6,5	61	*Solanum dulcamara L.*	23	3	5,5
19	*Hibiscus trionum L.*	8	0	6,0	62	*Solanum nigrum L.*	23	0	6,0

20	*Urtica dioica L.*	9	0	6,0	63	*Datura stramonium L.*	23	0	6,0
21	*Lythrum salicaria*	10	5	6,2	64	*Campanula persicifolia L.*	24	2	6,0
22	*Vicia craca L.*	11	3	5,5	65	*Cicorium intubus L.*	25	2	5,5
23	*Vicia angustifolia Reichard*	11	5	5,0	66	*Lactuca tatarica (L.) C.A.Mey*	25	2	5,0
24	*Vicia villosa Roth.*	11	3	5,0	67	*Cardus acanthoides L.*	25	5	6,0
25	*Viciatetrasperma (L.) Moench*	11	1	5,0	68	*Cardus nutans L.*	25	5	5,7
26	*Trifolium pratense L.*	11	5	5,7	69	*Cardus hamulosus Ehrh*	25	6	5,2
27	*Trifolium fragiferum*	11	5	5,0	70	*Arctium lappa L.*	25	6	6,5
28	*Trifolium montanum*	11	0	5,0	71	*Lathyrus tuberosus L.*	25	5	5,5
29	*Coronilla varia L.*	11	4	6,0	72	*Cyrsium palustre (L.) Scop.*	25	5	6,5
30	*Melilotus albus Medic*	11	0	6,0	73	*Cyrsium arvense (L.) Scop.*	25	4	6,5
31	*Linum austriacum L.*	12	1	4,7	74	*Xeranthemum annuum L.*	25	3	6,5
32	*Geranium robertianum L.*	13	5	5,0	75	*Onopordum acanthium L.*	25	5	6,5
33	*Geranium pratense L.*	13	2	6,0	76	*Centaurea pseudomaculosa***	25	5	6,0
34	*Polygonum aviculare L.*	14	0	5,5	77	*Galinsoga parviflora Cav.*	25	0	6,5
35	*Polygonum hidropiper L.*	14	0	6,5	78	*Achillea milefolium L.*	25	0	6,0
36	*Polygonum persicaris L.*	14	0	7,0	79	*Erigeron annuus (L.) Pers.*	25	0	6,0
37	*Rumex conglomerates Murray*	14	0	6,5	80	*Tripleurospermum inodorum****	25	0	5,5
38	*Fallopia convolvulus (L.) A. Love*	14	0	5,5	81	*Centaurea difussa Lam.*	25	0	6,0
39	*Conyza canadensis L.*	15	0	6,5	82	*Chamomilla recutita*****	25	0	4,5
40	*Daucus carota L.*	15	0	5,5	83	*Crepis pannonica C.Koch*	25	0	6,5
41	*Heracleum sibiricum L.*	15	0	6,0	84	*Connvalaria maialis L*	26	0	4,5
42	*Anthriscus sylvestris (L.) Hoffm*	15	0	6,0	85	*Allium rotundum L.*	27	6	6,7
43	*Caucalis platycarpos L.*	15	0	5,5					

Comments: C – color, F - flowering periods, T - order of the families evolutionary advancement,* - *Gaerth., Mey et Scherb,**- *Dobrokz,***- *Sch.Bip.,****- *(L.) Rauschert*

To check up the assumption, that "the general way of flora flowering in main features repeats the history of its development", we compared "T", that is the order of the families evolutionary advancement according to the phylogenetic system of flowering plants classification made by Takhtadzhian [1966], and the order of the specific flora flowering on the plots studied in Chisinau. Having ranged the presented plants sample (85 species) into groups with 5 families in each, we have got 5 classes of families with averaged flowering periods (Diagram 1).

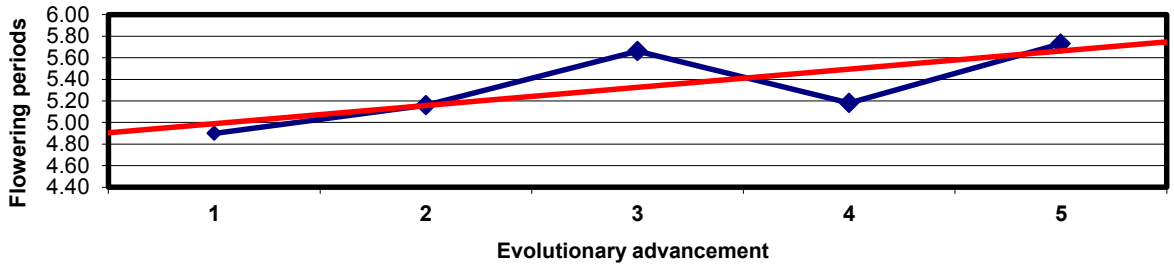

Diagram 1.Distribution of classes of dicotyledonous flowering plants with different evolutionary advancement on flowering time scale (1-5 is the species evolutionary class)

The trend line demonstrates the increase of the families evolutionary advancement with the increase of the average number of the month, in which flowering begins. Thus, if for the first five families the average number of the month, in which flowering begins, is equal to 4.89±0.26 (May), for the second, the third and the fourth family classes it is 5.16±0.14 and 5.18±0.17 respectively, so for the last five families this index increases for about a month and makes 5.73±0.13 (June).

Then before analyzing the plants species with flowers colored in antothyanin colors we would like to check up the following assumption: Does the proportion of white-flower plant species change

with the change of the families evolutionary advancement? For this purpose, we have counted the proportion of white-flower species in each of the five above mentioned ones (Diagram 2).

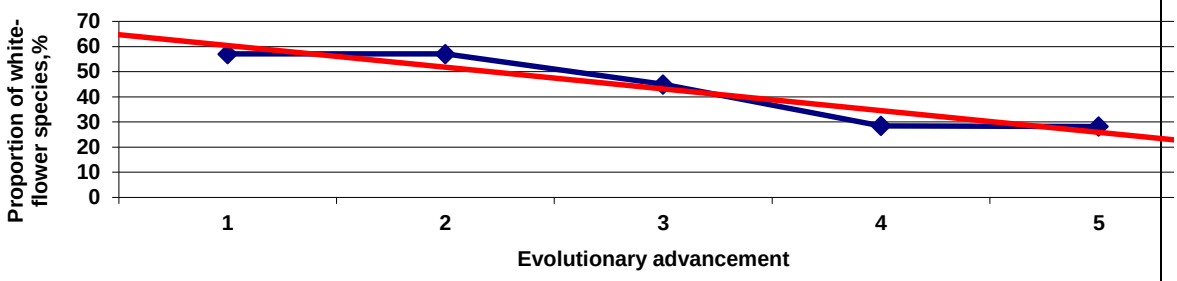

Diagram 2. White-flower species proportion in classes of dicotyledonous flower plants with different evolutionary advancement (1 – 5 are the species evolutionary classes)

The relative (referring to the anthocyanin-colored species) reduction of white-flower species proportion depending on the increase of the families evolutionary advancement was stated. In the first two classes of the families the proportion of white-flower species makes more than half of the species composition (57.14 percent); in the last two classes this index is approximately half lower (28.35 per cent). Thus, our data, received in the investigation of the concret flora of Chisinau, have partially proved the results of Nasimovich, based on the specific flora of Moscow region. The only difference was that in this comparison he took into consideration all found species of flowering plants, while we considered only anthocyanin-colored ones. The transitions between blue and purple flowers are caused by presence of pelargonidine, cyanidine and delphinidine pigments in flowers corolla.

Rausher [2008] while studying the transitions between the anthocyanin coloring of the angiospermous plants of Penstemon and Ipomoea genera, made a conclusion, that no one case of the synthesis switching from cyanidine to pelargonidine is known without flower coloring change from blue to red. In seven cases of the contrast transitions from blue to red coloring the reduction of anthocyanin hydroxylation was noticed. Thus, at least in two taxons of the angiospermous plants the evolutionary transitions from blue to red flowers are highly correlated with the pigment class change. It was assumed, that the pigment class change is caused by the inactivation of one or more branches of this way.

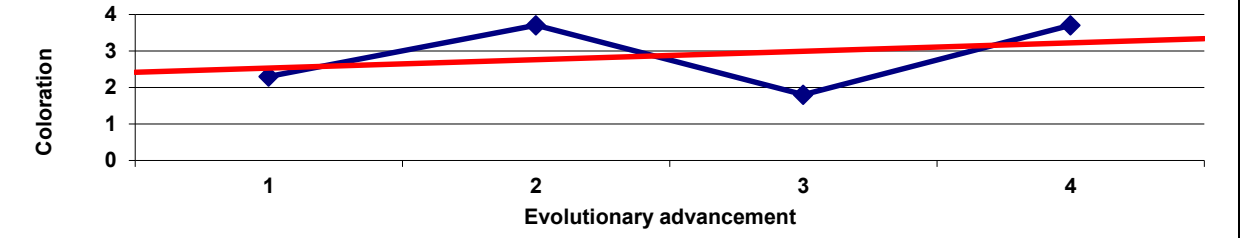

Diagram 3. Arrangement of dicotyledonous flower plants species with anthocyanine-colored corolla on the scale of the families evolutionary advancement (1-4 is the species evolutionary classes)

After the withdrawal of the species with white corolla coloring and the representatives of monocotyledonous ones (Connvalaria maialis L. and Allium rotundum L.) from the general list of the specific flora of Chisinau, the rest species were divided into four classes with different evolutionary advancement. The comparative analysis of 25 families of dicotyledonous flower plants with different evolutionary advancement has shown the insignificant tendency to corolla anthocyanin coloring from blue (2.4) to rose (3.7) (diagram 3). But due to non-equilibrium of the evolutionary classes (the first class includes 4 families and 5 species, but the four class includes 4 families and 20 species) this assumption requires more volume material studying. To simplify the studying of corolla anthocianin coloring dependency on the species evolutionary advancement on the level of genus taxons, we have chosen three flower plants genera (Table 2), that were different in their evolutionary advancement and that were characterized by the species composition enough for comparison: Viola (the 1-st class),

Vicia (the 2-nd class), Centaurea (the 4-rd class). The anthocyanin coloring shades, valued basing on the conditional scale from 1 (blue) to 6 (red), were arranged in such an order, in which they are changed at hydroxylation reduction. The mosaic corolla coloring was estimated by the most hydroxylated shade, as in this case the maximum level of hydroxylation does not reduce, simply the intermediate (less hydroxylated) products are also laid in flower tissues. Non-anthocyanin species (with white and yellow carolla) were not taken into consideration, as their anthocyanin way was inactivated in the very beginning of the biochemical chain, and we cannot consider the state of the genes, responsible for the subsequent reactions, including hydroxylation.

Table 2

Genera *Viola*, *Vicia* and *Centaurea* representation in potential flora of Moldova and their distribution according to corolla coloring and flowering periods (based on Geideman, 1986)

N	*Viola*	C	F	*Vicia*	C	F	*Centaurea*	C	F
1	*V. alba*	0	3-4	*V. hirsuta*	0	5-6	*C. thirkei*	0-6	5
2	*V. jordanii*	0	3-5	*V. grandiflora*	0	5-7	*C. diffusa*	0-j	6-9
3	*V. arvensis*	0	4-9	*V. tetrasperma*	1	5-6	*C. angelescui*	1-2	5-6
4	*V. nemausensis*	0	3-5	*V. pisiformis*	1	5-6	*C. cyanus*	2	5-10
5	*V. mirabilis*	1	4-5	*V. villosa*	3	5-8	*C. jacea*	3	6-10
6	*V. palustris*	1	4-5	*V. biennis*	3	5-6	*C. rhenana*	4	6-10
7	*V. collina*	1	4-5	*V. dumetorum*	3-1	5-6	*C. marschaliana*	4-5	5-6
8	*V. tanaitica*	1	4-5	*V. sylvatica*	3-1	5-6	*C. pseudomaculosa*	5	6-8
9	*V. elatior*	1	4-5	*V. cracca*	3-1	5-8	*C. bibersteinii*	5	6-9
10	*V. kitaibeliana*	1	4-7	*V. lathyroides*	3-4	5-6	*C. caprina*	5	6-8
11	*V. suavis*	2	4-5	*V. cassubica*	٧	5	*C. pannonica*	5	6-8
12	*V. hirta*	2	4-5	*V. striata*	3-6	5	*C. substituta*	5	7-8
13	*V. riviniana*	2	4-6	*V. peregrina*	5	5	*C. trinervia*	5	6-8
14	*V. odorata*	3	4-5	*V. pannonica*	5	5-7	*C. trichocephala*	5	6-9
15	*V. ambiqua*	3	4-5	*V. tenuifolia*	5	5-8	*C. pseudophrygia*	5	7-9
16	*V. reichenbachiana*	3	4-5	*V. sepium*	5	5-6	*C. stenolepis*	5	8-10
17	*V. canina*	3	4-6	*V. angustifolia*	5-6	5-6	*C. adressa*	5	6-9
18	*V. pumila*	3	4-6	*V. sativa*	5-6	5-6	*C. apiculata*	5	6-9
19	*V. persicifolia*	*	5-6				*C. stereophylla*	5	6-10
20	*V. matutina*	»	5-9				*C. iberica*	5	6-9
21	*V. tricolor*	×	6-8				*C. scabiosa*	6	6-10
22							*C. lavrencoana*	6	6-8
23							*C. solstitiales*	j	5-10
24							*C. adamii*	j	5-9
25							*C. orientalis*	j	6-10

Comments: C – color, F - flowering periods, * - 1-0-j, »-2-1-0-j, ×- 3-1-0-j,- ٧ 3-0-5,

In Viola-Vicia-Centaurea row (Tables 3) a definite shift towards later flowering and less hydroxylated coloring is observed. As this genera order coincides with traditional understanding of their evolutionary advancement (Takhtadzhian,1988), it is possible to assume, that younger genera tend to less hydroxylated coloring, take later seasonal niche and concede the earlier season to more primitive genera.

Table 3

Comparison of Viola, Vicia, Centaurea genera basing on anthocyanin coloring and flowering periods

Genus	Coloration in conventional units			Flowering periods		
	Mean	Number of species	Difference for Student, t	Mean	Number of species	Difference for Student, t
Viola	1,83±0,27	18	2,77**	4,05±0,14	22	6,37***
Vicia	3,19±0,41	16		5,05±0,06	18	
Centaurea	4,62±0,27	21	2,31**	5,92±0,14	25	6,10***

Comments: **P<0,01; ***P<0,001.

In order to make a valid conclusion, we added the genders from the potential flora of Moldova (Geideman, 1986) to the list of genera Viola, Vicia, Centaurea, being compared. Thus, the first group of the most evolutionary advanced genera included genera as follows: Viola – 18 species, Clematis – 4 species, Pulsatilla – 3 species, Nigella – 4 species, Fumaria – 4 species and Lythrum – 3 species. The second group included Vicia genus-16 species, Geranium – 14 species and Veronica – 27 species. The third, the most evolutionary advanced group, was represented by Centaurea genus – 21 species, Cirsium – 13 species and Salvia – 10 species. Due to the species small number of the first group genus, the average value of corolla coloring and flowering periods was found not for each gender separately, but for the sum of all genera (except Viola genus). The results, given in Diagrams 4 and 5, confirm the conclusions, made in comparison of Viola, Vicia, Centaurea genera, based on anthocyanin coloring and flowering periods.

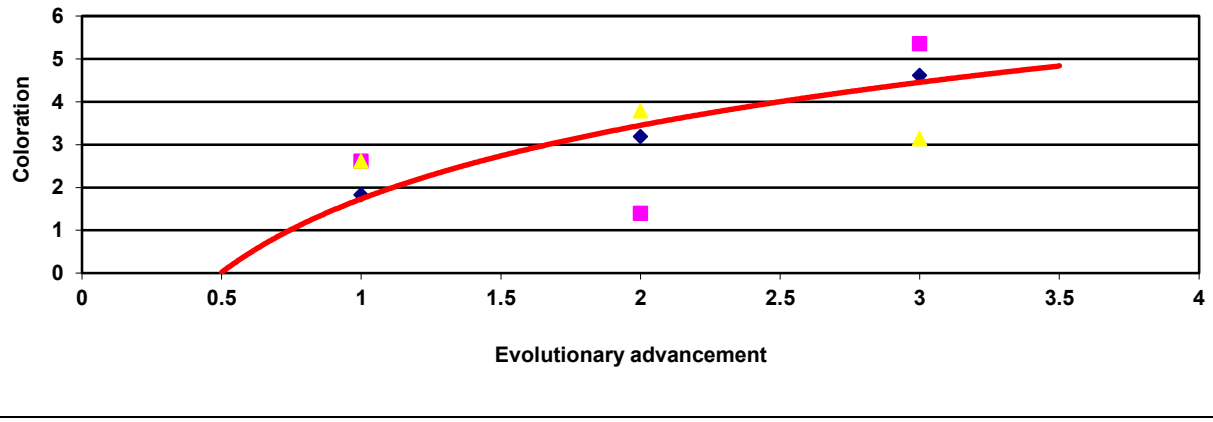

Diagram 4. Distribution of genera with different evolutionary advancement (1, 2, 3) according to anthocyanin coloring type (1-6)

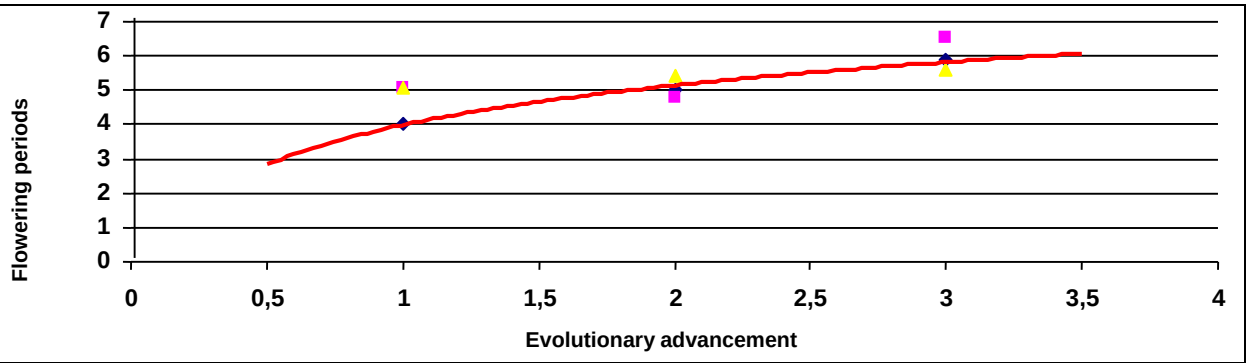

Diagram 5. Distribution of genera with different evolutionary advancement (1, 2, 3) according to flowering periods

Conclusions.

1. The reduction of white-flower corolla species and the increase of anthocyanin-colored corolla species are observed with the increase of families evolutionary advancement.

2. For anthocyanin-colored corolla species the reduction of anthocyanin pigments average hydroxylation is recorded with the increase of the families evolutionary advancement, that is shown in the reduction of proportion of the species with light blue, blue and violet corolla, as well as in the proportion increase of the species with rose, crimson and purple corolla.

3. There is a connection between the species flowering periods and their evolutionary advancement, so with the flowering periods increase the families evolutionary advancement increases, the species proportion with white and violet-blue corolla reduces, and the species proportion with rose-purple corolla increases.

4. The seasonal convergence of flowering plants species was stated basing on corolla coloring.

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Categoria C *ISSN 1857-3517*

THE MODIFICATION OF CONCENTRATION OF ASSIMILATING PIGMENTS IN SOME SPECIES OF TREES UNDER THE ACTION OF TRANSPORT EMISSIONS

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It was established that that the essential impact on the leaves (the generation process of chlorophyll "a" of Tilia cordata it causes the conditions at CET-1, followed by Alecu Russo subsequently Moscow avenue and the diminished it is for the Botanic Gadin.

Data analysis on the content of chlorophyll "a" chlorophyll "b" for Tilia cordata is 2.8 times higher chlorophyll "a" and 2.6 times for chlorophyll "b" compared with values for Pinus nigra chlorophylls. These results confirm that process of generating Tilia cordata chlorophyll species is larger than the species Pinus nigra.

It was determined that the impact of vehicle emissions on the generation of chlorophyll "b" is unimportant for all stations.

The data demonstrates that the greatest impact of vehicle emissions it causes the chlorophyll "a" and therefore as an indicator of the degree of pollution is required to receive the content of chlorophyll "a".

It was determined that the impact of road transport emissions to be measured by the ratio value of chlorophyll "a" / "b" for each station. The more value ratio is lower by both the impact is essential, and conversely, higher value ratio corresponds a minimal impact.

Keywords: chlorophyll "a" and "b", auto emissions, bioassay, air quality.

In recent decades, humanity concerning for cleaner and healthier air is turning more and more to bio surveillance, namely the pursuit reactions at all levels of organization of living matter as compared morphological, biochemical, physiological and ecological, to reveal the alteration of the environment and watch its evolution [12].

The quality of air in cities, including Chisinau is influenced mainly by emissions from road transport, followed by electro power stations, boilers and large enterprises from the construction industry, in district centres and villages - emissions from processing enterprises [2].

Auto transport is the main source of air pollution in urban conditions. Parallel to harmful emissions, transport eliminates enormous amounts of carbon-dioxide, the main gas responsible for the greenhouse effect (about 55% of the greenhouse potential effect on Terra). It is known that cars introduce in atmosphere about 4 t CO_2 – km^2 per year [9].

Vegetation is an invaluable natural resource that creates specific microclimate able to reduce the unfavourable nuisances and ensure circuit of CO_2, N_2, O_2 etc, into the atmosphere. In addition, it is the ability of some plants to indicate the level of pollution of environmental components [1].

The impact of pollutants emitted into the atmosphere over vegetation is a widely documented phenomenon. Plants have a large area and their leaves are an effective abatement device in of pollutants, therefore their assimilative organs are directly affected by air pollution.

It is known that the content of chlorophyll in leaves is an important parameter used in plant's bioassay. For example, it can be used as an indicator of photosynthetic potential, as well as plant productivity [3; 10].

The impact caused to plants in Chisinau is expressed through direct influence of the content of photosynthetic pigments – chlorophyll "a", "b" and carotenoids. The process of photosynthesis is very sensitive to environmental pollution with SO_2, As_2O_3, H_2S, herbicides, insecticides and chloroform. [2; 5]. The degree of harmful exhaust emissions decrease according to the following sequence: SO2> NO> CO> CO2, pollutants priority destroying chlorophyll "a" and carotene [2; 11].

The purpose of this paper is to investigate the environmental impact of pollutants emitted by road transport on vegetation from Chisinau on the example of tree species (*Pinus nigra, Tilia cordata, Platanus acerifolia).*

Materials and methods.

Research on exhaust emissions impact on the content of pigments in the leaves was performed in 5 stations (Figure 1).

To see the impact of emissions on the concentration of assimilating pigments (chlorophyll "a" and "b") of some tree species *(Pinus nigra, Tilia cordata, Platanus acerifolia)* [4] 5 stations were selected (Figure 1):

- Circle CHP 1 plant, urban type, traffic and industrial zone, located near the North Station in city Chisinau and CHP plant 1 that works only in the cold season of the year, stationary post of air quality monitoring;
- Calea Iesilor str, urban type, traffic, stationary post of air quality monitoring;
- Alecu Russo str. urban type, traffic;
- Moscow avenue, urban type, traffic, stationary post of air quality monitoring;
- Botanical Garden, control station.

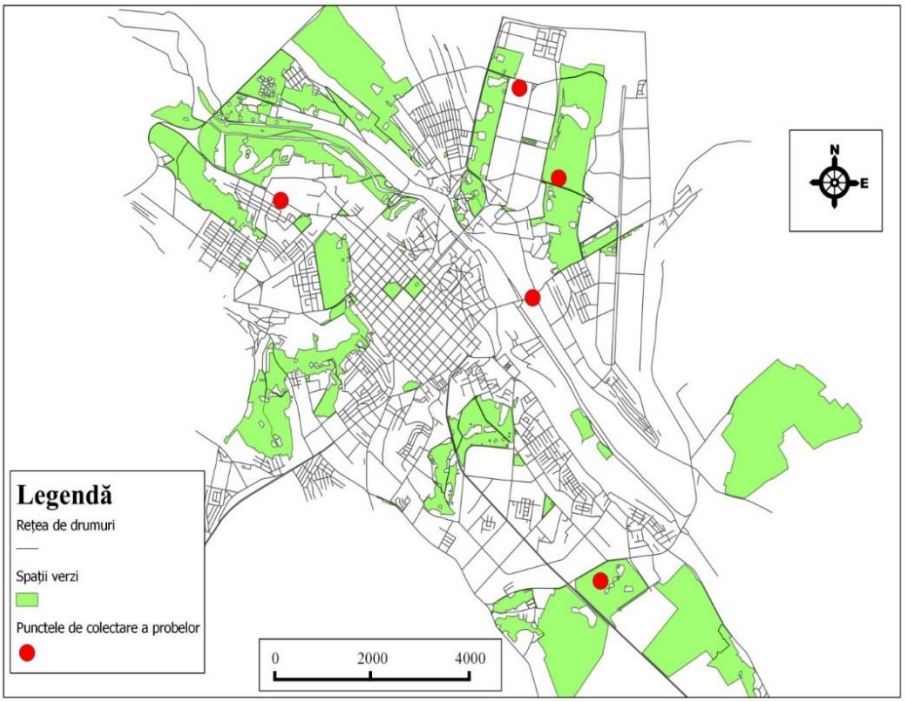

Fig. 1 Location scheme of sampling points

Leaf samples were collected from the above-mentioned three species of trees from five specimens. Sheet material was collected according the method [6] for hardwood, stems from the middle of the year, located in the upper third part of the crown.

Regarding the amount of leaves collected were selected three branches of 0.5 m length of each tree species selected, which resulted in about 30 leaves. For transportation to the laboratory, for extraction the pigments, leaves were collected in polyethylene bags, which were perforated (to avoid overheating) and were labelled.

Determination of chlorophyll pigments “a’’ and “b” was performed by spectrometry of alcoholic extract of leaves. [7]

To ensure the maximum extraction of the pigments, the sheet material from each polyethylene bag was shredded using scissors. The average sample was taken and was weighed 0,5g, for future shredding in the mortar. After shredding assimilating pigments were extracted in ethyl alcohol 96% using steam bath at 65ºC.

Measurements were performed on the contents of the spectrophotometer pigments СФ 46 ЛОМО the following wavelengths:

- 665 nm for chlorophyll "a";
- 649 nm for chlorophyll "b"

Concentrations were calculated based on the following formula [7]:
Chlorophyll "a"= [(13,95 • A665 – 6.88•A649)/d•1000•W]•V•D mg/g fresh substance;
Chlorophyll "b"= = [(24.96 • A649 – 7.32• A665)/d•1000•W]•V•D mg/g fresh substance;
Where:
A - absorbance at the wavelength indicated;
V - total extract volume (ml);
D - Dilution factor;
W - The initial weight of the plant material (g);
d = thickness of cuvette (1 cm);
1000 = Conversion factor µg in mg;
The results were statistically analyzed using program MO Excel 2010.

Results and discussions.

The quality of air.

During 2014 in Chisinau were taken and analyzed 24,069 samples of air from 6 stationary observations based on 7 indicated by State Hydrometeorological Service: solids, sulfur dioxide, soluble sulfates, carbon monoxide, nitrogen dioxide, phenol and formaldehyde.

Significant concentrations exceeded the annual average was recorded for nitrogen dioxide - 1.5 MAC, nitrogen oxide - 1.2 MAC and formaldehyde - 3.3 MAC.

According to investigations, exceeding the monthly average concentrations were recorded for nitrogen dioxide and formaldehyde during the year, mainly due to the combustion of solid, liquid and gaseous fuels in various industrial plants, residential, commercial, and institutional and road transport.

During 2014 the highest daily average concentration values and momentary maximum were recorded for carbon monoxide and nitrogen dioxide, the greatest contribution to the accumulation of substances in the atmosphere is from emissions from combustion processes of internal combustion engines, noise and vibration and - in major intersections, along the roads, near hubs and airports.

Analyzing stationary ambient air quality stations POP no. 3 – 21 Calea Iesilor str.; POP no. 4 – 1 Tudor Vladimirescu str., (CHP 1 plant circle); POP no. 8 - 21 Moscow avenue, for pollutants which surpassed the MAC, the research stations placed around the content assimilating pigments (chlorophyll "a" and "b") are shown in Fig. 2-12.

For POP 3 we have:

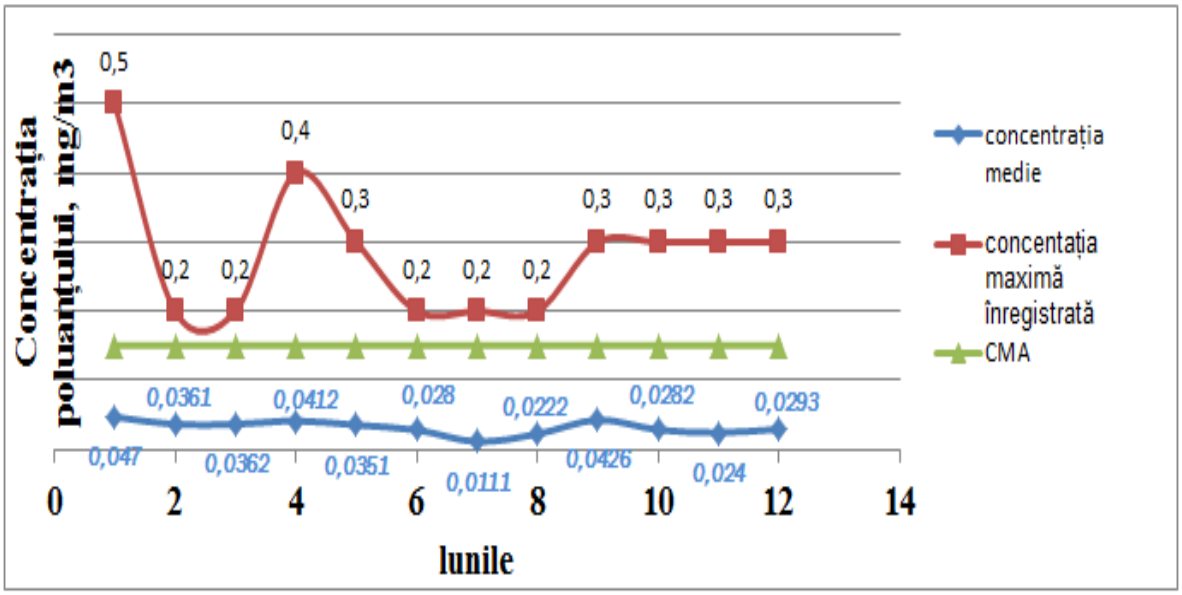

Fig. 2. Dynamics of air pollution during 2014 with solids

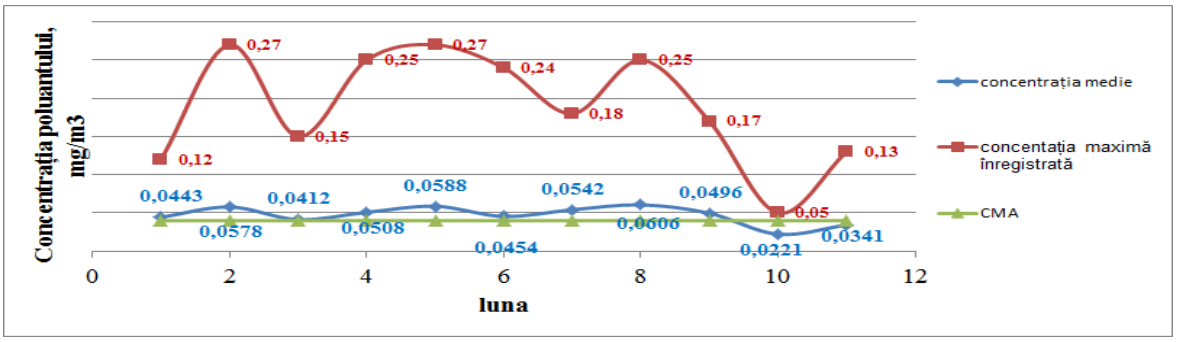

Fig 3. Dynamics of air pollution during 2014 with nitrogen dioxide

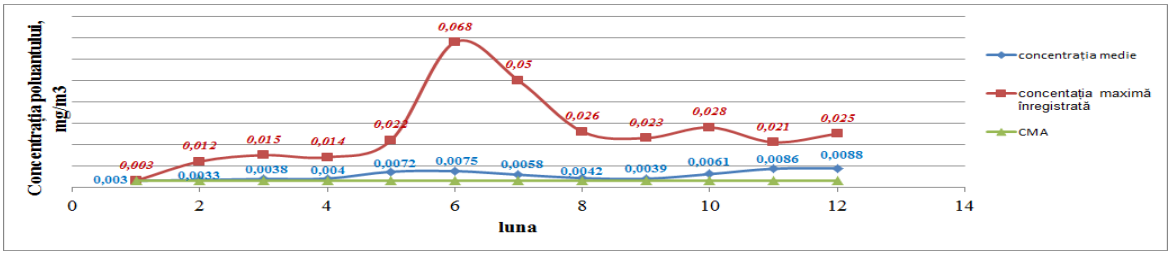

Fig. 4. Dynamics of air pollution during 2014 with formaldehyde

For POP 4:

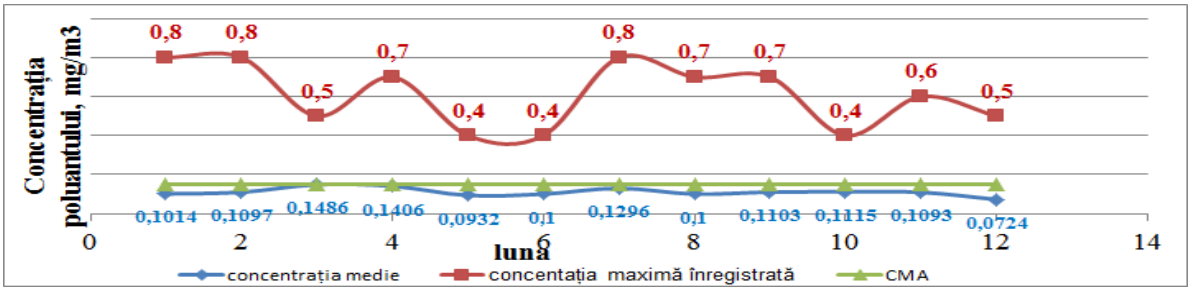

Fig. 5. Dynamics of air pollution during 2014 with solids

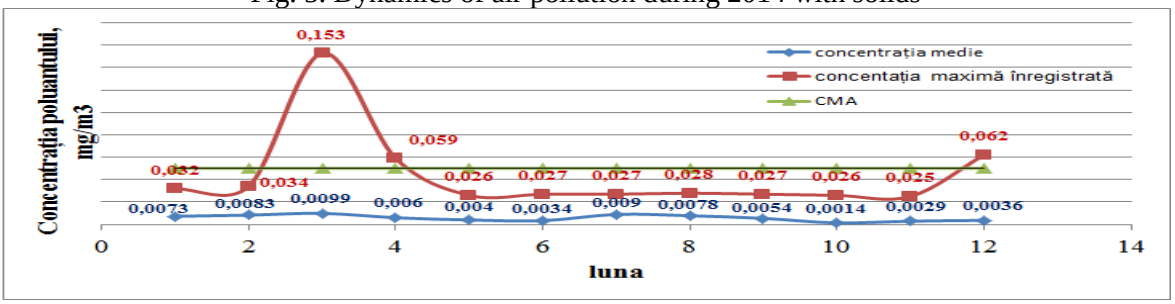

Fig. 6. Dynamics of air pollution during the 2014 sulfur dioxide

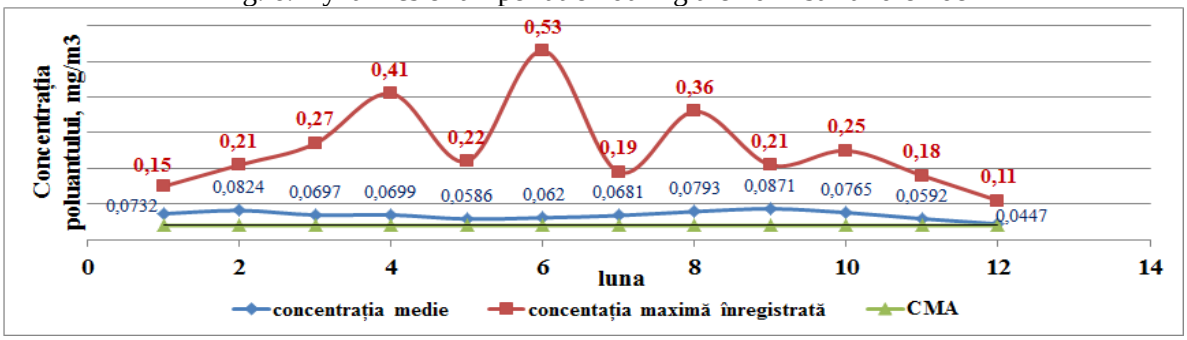

Fig. 7. Dynamics of air pollution during 2014 with nitrogen dioxide.

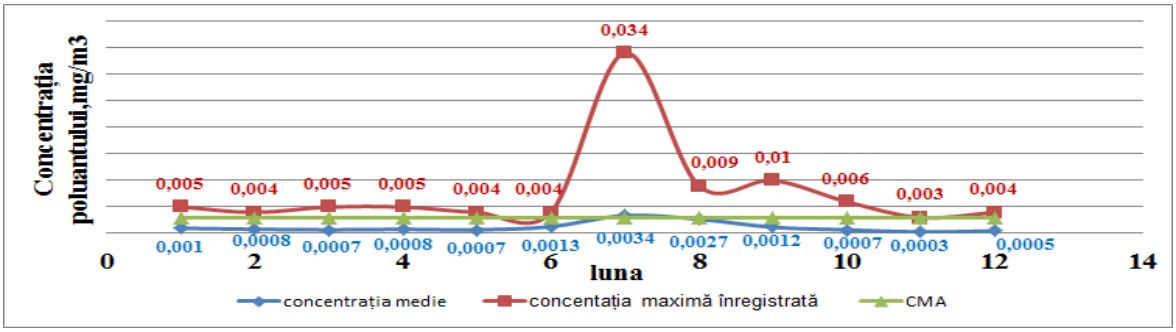

Fig. 8. Dynamics of air pollution during 2014 with phenol.

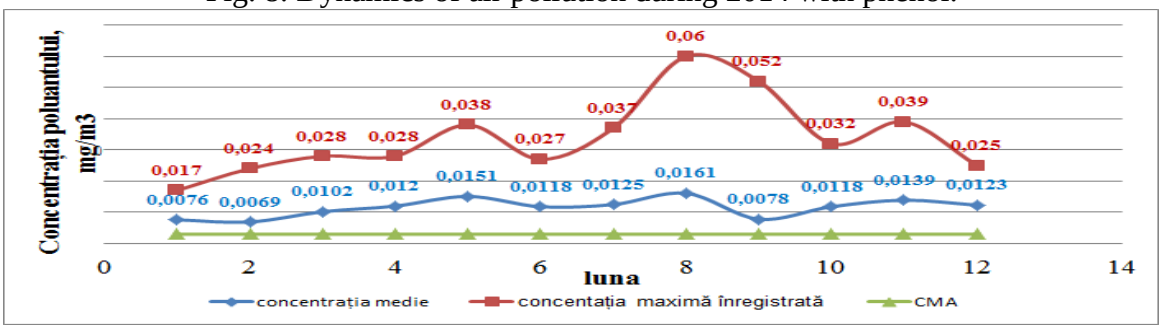

Fig. 9. Dynamics of air pollution during 2014 with formaldehyde

POP 8

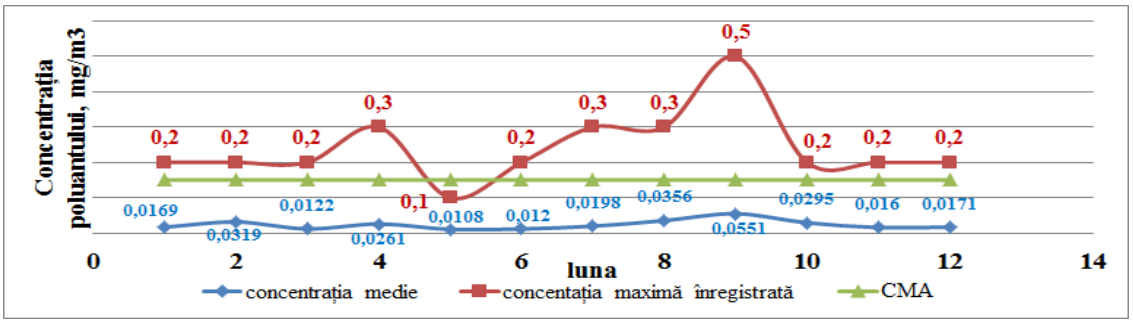

Fig. 10. Dynamics of air pollution during 2014 with solids

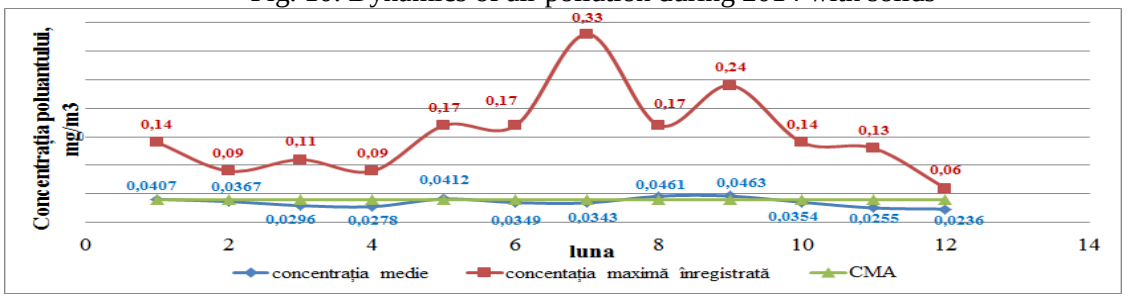

Fig. 11. Dynamics of air pollution during 2014 with nitrogen dioxide

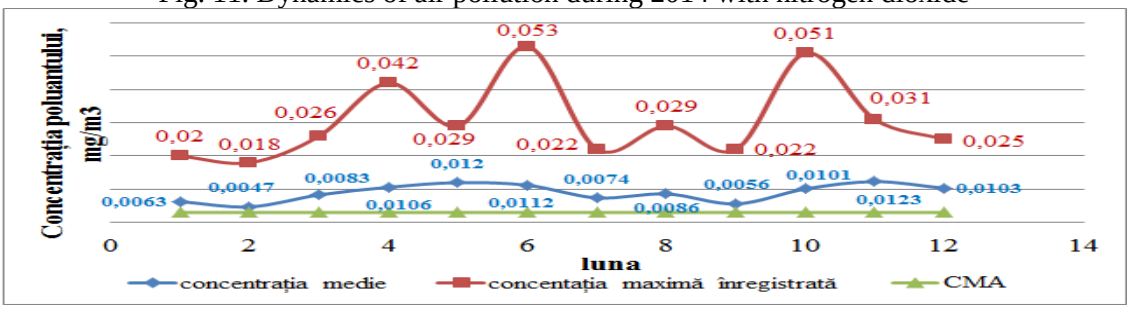

Fig. 12. Dynamics of air pollution during 2014 with formaldehyde

The data for POP 3, POP 4 and POP 8 shows that the maximum concentrations for several pollutants exceeding maximum permissible concentrations was recorded. These data confirm that indeed there is an air pollution which is confirmed by maximum concentrations recorded.

The main pollutant of atmospheric air recorded by State Hydrometeorological Service at these stations is nitrogen oxides. Nitrogen oxides present in the atmosphere causes damage to plants. But it is difficult to determine exactly which effects are the direct results of nitrogen oxides and secondary pollutants produced the action photolytically cycle of nitrogen oxides. It turned out that some of these secondary pollutants are highly deleterious to the plant. The action of high concentrations of nitrogen dioxide to the plants may be due to the formation of nitric acid [8].

To find the real conditions that occurred during study of the impact of pollutants generated by automobiles and other sources on the vegetation were recorded wind speed, air temperature, humidity (Figure 13) and wind direction (wind rose) (Figure 14). The data indicate that wind speed almost the entire period of research in medium was constant 2.5-2.7 m / sec. Maximum temperature during the research period constituted in August- 23,2º C. The highest relative humidity was in February (88%) and November (82%) and in investigation period during April-August ranged between 61% -51%.

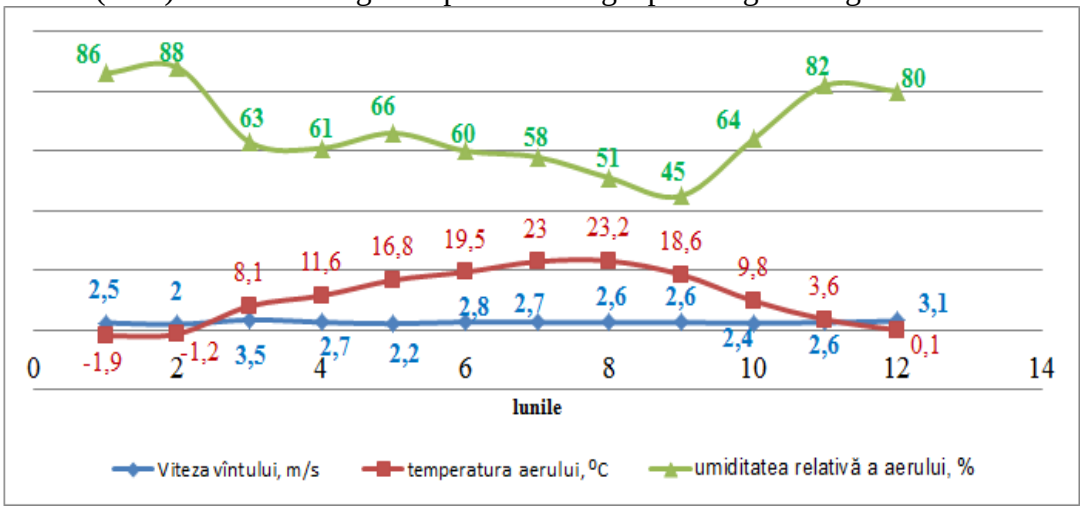

Fig. 13. Wind speed, temperature and humidity throughout the year. 2014

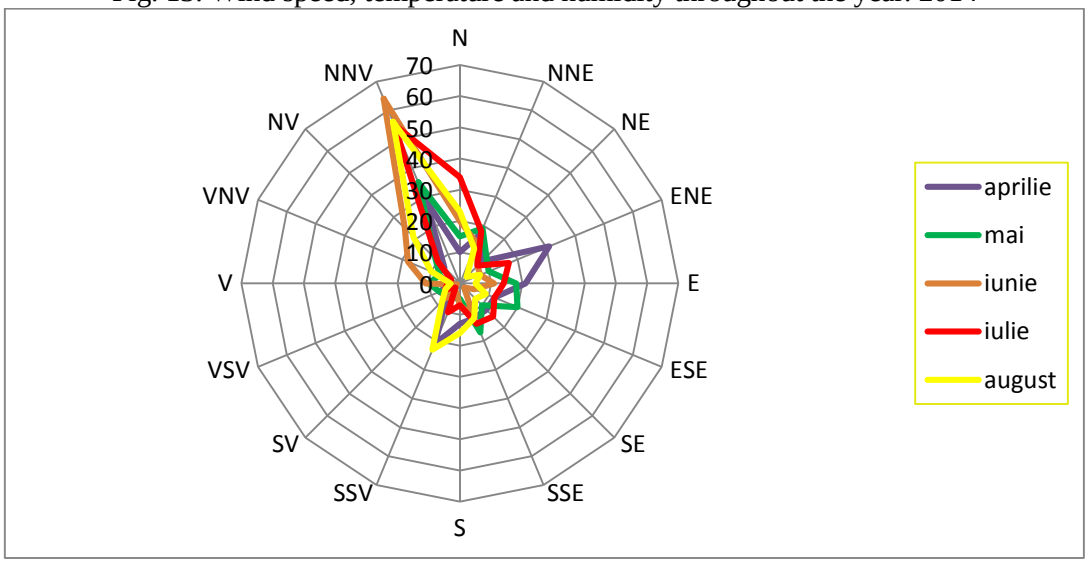

Fig. 14. Wind direction during vegetation dynamics in plants. 2014

The result of research reveals that the lowest content (2.07 mg / g of fresh substance) of chlorophyll "a" was recorded in Tilia cordata (Fig. 15) in the station CHP 1 plant followed by station Alecu Russo str. with 2.49 mg / g of fresh substance; station from Moscow avenue with 2.98 mg / g

of fresh substance, and the highest values were recorded in the control station from Botanical Garden str. 3.15 mg / g in fresh substance. For chlorophyll "b" no significant difference values were recorded, ranging between 0.83 and 0,88mg / s g in fresh substance. The ratio of chlorophyll "a" and "b" as well as total content (a + b) showed the same trends: CHP 1 plant< Alecu Russo str. < Moscow avenue<. Botanical Garden .

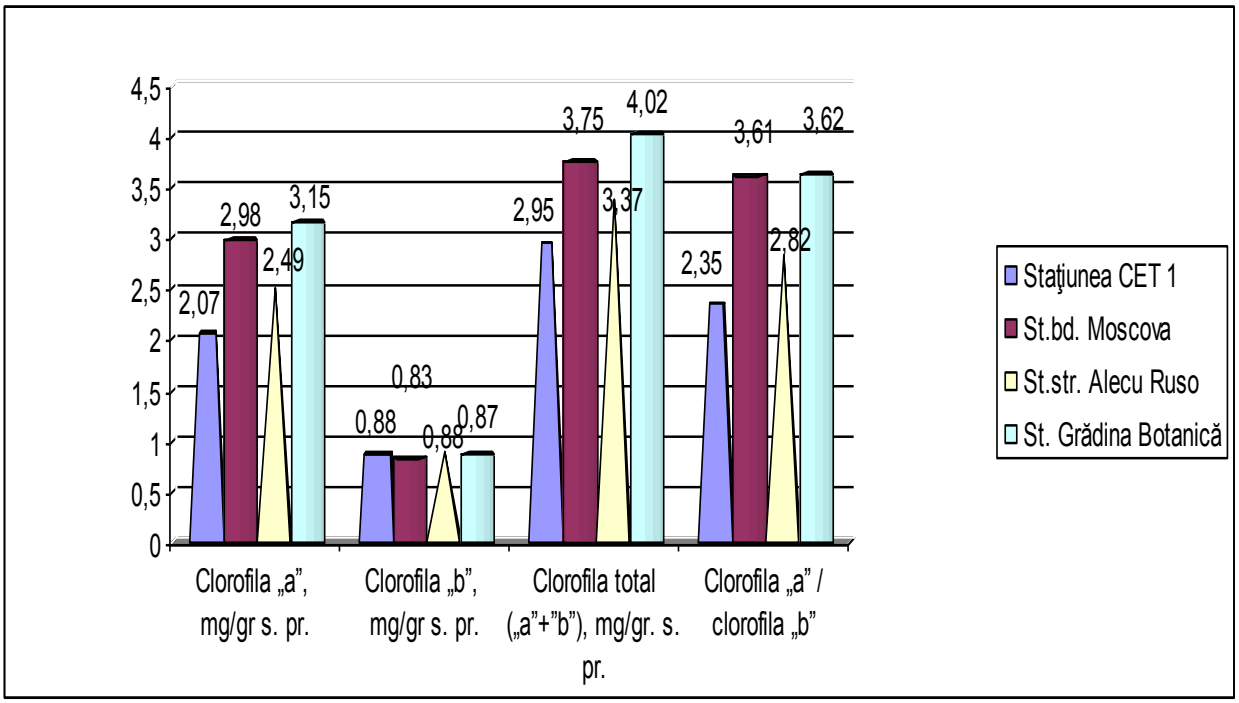

Fig. 15. Changing the content of pigments (chlorophyll a + b) Tilia cordata in leaves

The results of analyzes carried out demonstrates that the maximum chlorophyll "a" was established in samples collected from the Botanical Garden str. This fact may be explained by the high degree of pollution of the other resorts, where Tilia cordata grow and develop.

Like in Tilia cordata and in Pinus nigra (Figure 15) were seen the same trends of varying content assimilating pigments (chlorophyll a + b): CHP 1plant < Alecu Russo str. < Moscow avenue <. Botanical Garden str. For Pinus nigra was observed that the ratio of chlorophyll in control station "a" and "b" in the collected material is much higher (4.49) compared to the other investigated resorts (2.17 and 2.45).

The data from figure 15 demonstrates that the greatest impact on the leaves (the generation process of chlorophyll "a") of Tilia cordata is caused by the conditions in CHP-1 plant, followed by Alecu Russo str, Moscow avenue and the subsequent is diminished for Gradina Botanica str. Analysis of data on the content of chlorophyll "a" chlorophyll "b" in Tilia cordata is 2.8 times higher than chlorophyll "a" and 2.6 times for " chlorophyll b" compared for the same values for Pinus nigra. These data confirm that the process of generating chlorophyll for species Tilia cordata is more essential than the species Pinus nigra.

The analysis of results of the impact of road transport emissions content of chlorophyll "a" and "b" has established that the impact on generation of chlorophyll "b" is unimportant for all stations. The data demonstrates that the greatest impact of road transport emissions it causes chlorophyll "a" and therefore as an indicator of the degree of environmental pollution is required to accept the content of chlorophyll "a" for Tilia cordata. Based on these results we can make a very important conclusion, which is that emissions impact generated by auto transport can be characterized by the value ratio chlorophyll "a" / "b" for each station. The lower value ratio shows that the impact is higher, and vice versa, higher value ratio means a minimal impact.

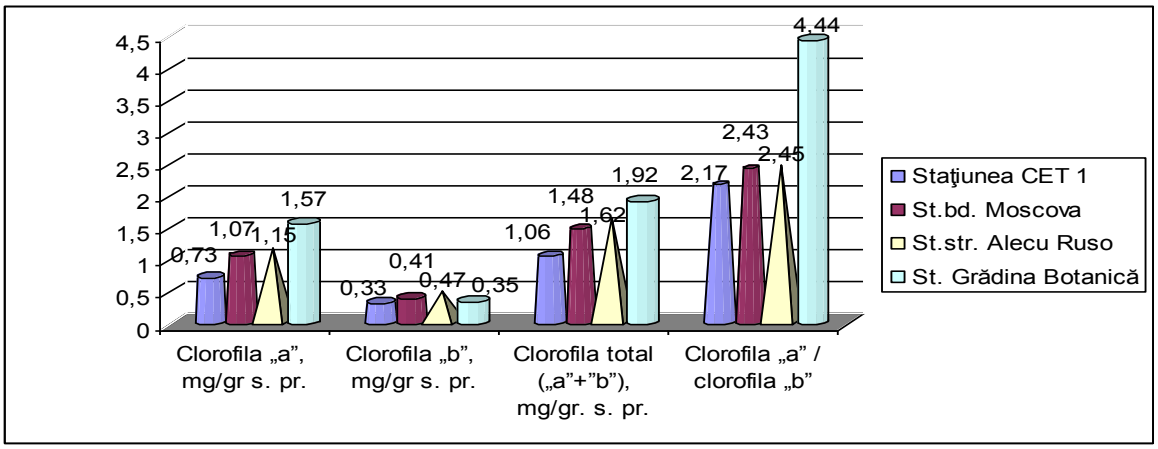

Fig. 16. Change contents of pigments (chlorophyll a + b) in those of Pinus nigra

For Platanus acerifolia (Fig. 17) were selected two stations: CHP 1 plant and Calea Iesilor str. After the experiment was determined that values of the content of chlorophyll "a" and "b" were slightly higher for station CHP 1 plant (1.27 and 0.43 mg / g , respectively) compared with Calea Ieşilor str. - 1.14 and 0.33 mg / g. The ratio of chlorophyll "a" and "b" was 2.95 and 3.45, respectively.

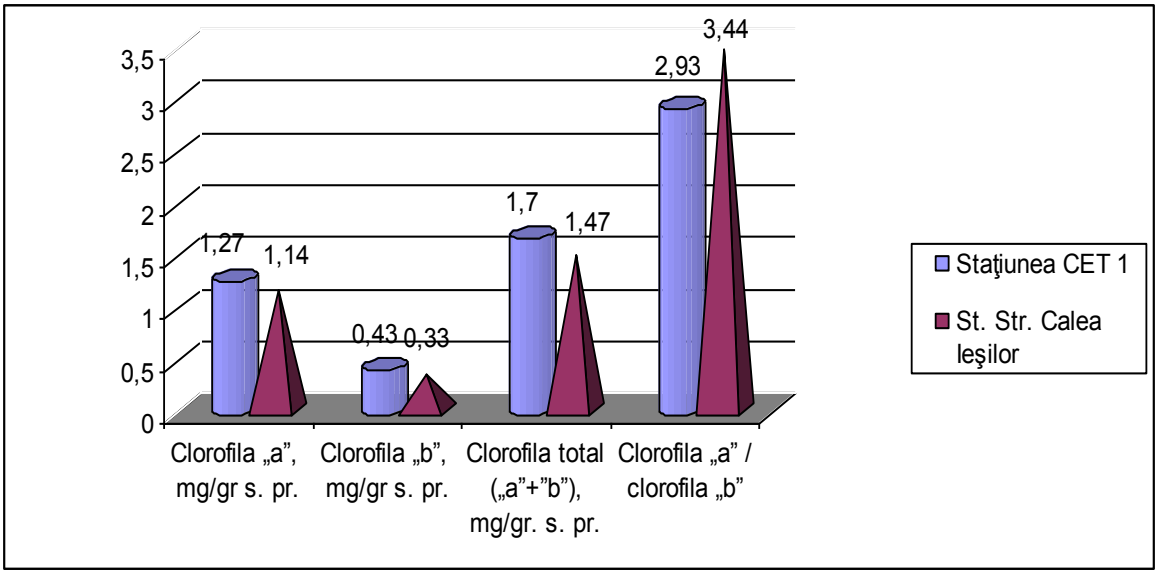

Fig. 17. Changing the content of pigments (chlorophyll a + b) Platanus acerifolia leaves

The results indicate the fact that pollution levels in station Calea Iesilor str. is more pronounced than in station CHP 1 plant.

Based on test results obtained we can conclude that the impact on chlorophyll "b" is unimportant for all stations. The data demonstrates that the greatest impact of road transport emissions on chlorophyll "a" and therefore is as an indicator of the degree of environmental pollution and is required to accept the content of chlorophyll "a" for Tilia cordata.

The data in fig. 14 about the dynamics of wind direction during the year 2014 and indicates the fact that the level of air pollution in studied stations is caused by pollutants brought by air masses of city space as a result of the wind.

Conclusions:

1. For *Tilia cordata* pigment chlorophyll content and ratio of chlorophyll "a" and "b" increases in the order: CHP 1 < Alecu Russo str. < Moscow avenue < Botanical Garden str..The same trend is observed and for *Pinus nigra*. For *Platanus acerifolia* the lowest concentration was recorded in Calea

Iesilor str. and not in CHP 1 and the value ratio between chlorophyll "a" and "b at the CHP 1 plant is in the range of values determined for other species.

2. Data analysis of the content of chlorophyll "a" chlorophyll "b" in Tilia cordata is 2.8 times higher than chlorophyll "a" and 2.6 times thanchlorophyll " b" compared to their content for the species Pinus nigra. These results confirm that the process of generating of chlorophyll in Tilia cordata species is higher than in the Pinus nigra species.

3. It was determined that the impact of emissions of road transport on chlorophyll "b" is unimportant for all stations. The data demonstrates that the essential impact of vehicle emissions it caused on the chlorophyll "a" and therefore as an indicator of the degree of pollution is required to accept the content of chlorophyll "a".

4. It was determined that the impact of emissions of road transport can be characterized by the value ratio of chlorophyll "a" / "b" for each station. As the value ratio is lower the impact is higher, and vice versa, higher value ratio corresponds a minimal impact.

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ACCELERATION OF ANODE DISSOLUTION OF TUNGSTEN AND ITS ALLOYS IN NEUTRAL SOLUTIONS OF SALTS

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Изучено влияние различных концентраций добавок бисдиметилглиоксиматодитиокарбамид-кобальт (III) нитрат и гидроксиметилсульфинат на процесс анодного растворения вольфрама, кобальт вольфрама и предложенных твердых сплавов WC-Co в растворах NaCl и $NaNO_3$. Показано различное влияние добавок (как комбинированно, так и отдельно) на процесс растворения металлов.

Ключевые слова: вольфрамовые сплавы, анодное растворение, пассивационные пленки.

Influence of various concentration of additives of bisdimethylglioximato- dithiocarbamidecobalt (III) nitrate and hidroximethilsulfinate sodium on process of anode dissolution W, WC and suggestions solid alloys WC-Co in solutions NaCl and $NaNO_3$ is studied. Various influence of additives (as combined and separate) on process dissolution metals is shown.

I. Introduction

It is known /1/, that anode dissolution of tungsten in neutral water solutions of salts take course to insignificant speed because of passivation of the surface by the oxide film. In water solutions of electrolytes electrode reaction of dissolution of tungsten passes, at least, in two stages:

$W + 6OH^- \rightarrow WO_3 + 3H_2O + 6e^-$ (1)

$WO_3 + 8OH^- \rightarrow WO_4^{2-} + H_2O$ (2),

first of which – electrochemical, the second – chemical. Excess superficial concentration of OH^- ions is necessary for course with sufficient speed of reaction (2), and they are obviously insufficient in neutral water solutions of salts.

Previously we came out with the assumption/2/, that introduction in electrolyte of a reducer will increase the speed of dissolution of tungsten, not allowing to bind its ions with oxygen and translating them in a solution. As a reducer we have used rongalit C – hidroximethylsulfinat sodium and $[Co(DH)_2thio_2]NO_3$, where DH – the rest of dimethtylglioxime, thio- thiourea separately or in a mixture.

2. Experimental

Anode polarization curves were taken on a rotating disk electrode with diameter of 3 mm with speed of development of potential 40 mV/s using potentiostat P-5848. Potentials were measured comparatively the chlorine-silver saturated electrode, and then recalculated comparatively a normal hydrogen electrode. As the material for the electrodes have been used ceramet of tungsten of type WC, sintered firm alloy WC-8 (carbide tungsten of 92% weight, a cobalt sheaf of 8% weight) and both cast carbide tungsten and cobalt. Treatment was performed in water solutions of chloride 150 g/1 or nitrate 150 g/1 sodium without and with additives of reducers.

Rongalite C was twice recrystallized from water in presence of a small amount of formaldehyde. $[Co(DH)_2thio_2]NO_3$ was received according to /3/ by oxidation by oxygen of air of a reactionary hydroalcoholic mixture hexahydrate nitrate of cobalt, dimethyglioxime and thiourea taken in molar proportion 1:2:2 respectively.

3. Results and discussions

Researches have shown a various degree of influence of additives on process of dissolution of tungsten and alloys on its basis in electrolytes NaCl and $NaNO_3$. Small concentration of additives in solution NaCl (150 g/1) lead to small growth of a current at dissolution of tungsten, and influence of speed mass transfer on anode process in this case is practically imperceptible. Introduction of 15.5 g/1 of rongalite and 0,2 g/1 of cobalt (III) dioximate gives almost five times fold increase in speed of dissolution (fig. 1).

Increase of temperature from 20 up to 50 °C does not change the character of influence of the additive on process of dissolution, but the increase of temperature promotes an intensification of process in a much greater degree, than in a basis electrolyte – without the additive (fig. 2).

The introduction of only complex compound, without changing the character of a polarization curve carbide tungsten, complicates the process of dissolution, shifting potentials of both peaks in the positive part. Addition of 0.2 g/1 of rongalit complicates the process of dissolution even more. More significant decrease in speed of dissolution is observed at addition in electrolyte of a mixture 15.5 g/1 of rongalite and 0.2 g/1 of a complex of cobalt (III). The intensification of dissolution due to increase of electrolyte temperature is not so essential, as at dissolution of tungsten.

The influence of additives on dissolution of cobalt is ambiguous. At addition in the electrolyte, for example, of 0.3 g/1 of rongalite and 0.3 g/1 of complex compound of cobalt the speed of dissolution of metal falls on 20-30 % whereas the additive 0.3 g/1 of rongalite and 0.2 g/1 of the complex intensifies the process of dissolution more than 2.5 times. The increase in of electrolyte temperature leads to even greater increase of speed of dissolution of metal.

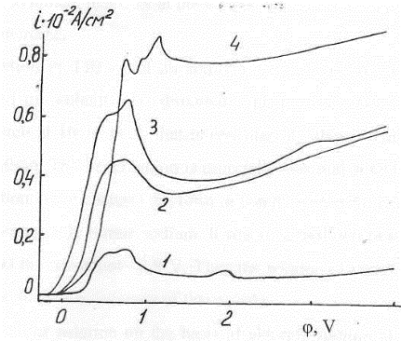

Fig. 1. Potentiodynamical polarization curves of anode dissolution of tungsten in electrolytes (g/1):
1 - NaCl 150; 2 - NaCl 150 +rongalite 0,6+$[Co(DH)_2thio_2]NO_3$;
3 - NaCl 150 + rongalite 1,77 + $[Co(DH)_2thio_2]NO_3$ 0,2;
4 - NaCl 150 + rongalite 15,5 + $[Co(DH)_2thio_2]NO_3$ (n = 1500 r/min, 40°).

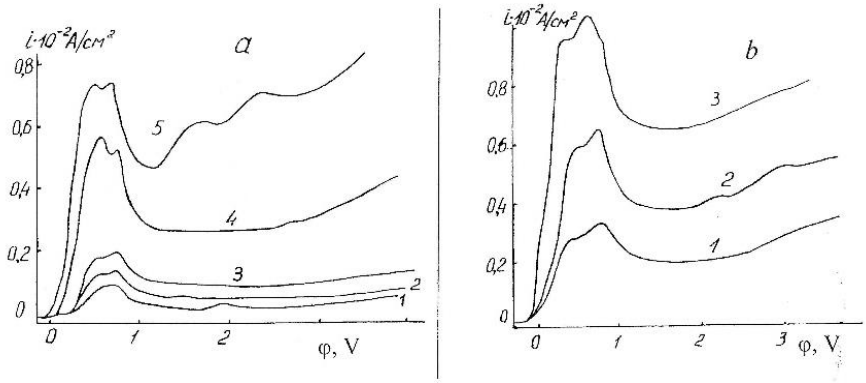

Fig. 2. Potentiodynamical polarization curves of anode dissolution of tungsten in electrolytes (g/1);
NaCl 150 (a) и NaCl 150 + rongalite 1,77 + $[Co(DH)_2thio_2]NO_3$0,2 (b)
at temperature, °C: 1 - 20, 2 - 40, 3 - 50, 4 - 70, 5 - 80 (n = 1500 r/min).

The additive in electrolyte of 0.2 g/1 of the complex compound shifts the potential of dissolution of alloy VC-8 in the positive part, and the introduction of a mixture of 0.2 g/1 of rongalite and 0.2 g/1 of the complex complicates the dissolution of the alloy even more. It would seem optimum for tungsten, but a little bit worsening the process of dissolution carbide tungsten and cobalt the additive of a mixture 15.5 g/1 of rongalite and 0.2 g/1 of the complex compound of cobalt sharply reduces the speed of dissolution of two-componental alloy VC-8. Thus it is necessary to notice, that only at the temperature of 50 °C of electrolyte and more the etching of an alloy increase.

The introduction of 150 g/1 of an additive in the form of a mixture of 15.5 g/1 of rongalite and 0.2 g/l of cobalt(III) dioximate in the electrolyte $NaNO_3$ intensifies the dissolution of tungsten at 10-12 time, that is considerably above, than in electrolyte on the basis of chloride sodium. This acceleration is especially essential at temperature of electrolyte 50 °C. The polarization curve changes the form in comparison with that which is observed in the electrolyte containing only nitrate sodium. It was observed two peaks of a current: one at potential ~0.8 V, and the second – at ~2.8 V. Thus the relation of components of the additive does not influence the area of occurrence of these peaks.

Defferent from the solution on the basis of chloride sodium at polarization carbide tungsten in electrolyte on the basis of nitrate of sodium the current in the field of the second peak considerably increases, in instead of the first one there are two, but at more negative values of potentials.

Otherwise, in the solution NaCl the introduction of additives influences anode dissolution of alloy VC-8. The form of a polarization curve thus does not vary, however process of dissolution of an the alloy is a little facilitated.

4. Conclusion

Thus, it is revealed, that hidroximethylsulfinat sodium as the reducer, in a mixture with bisdimethylglioximatoditiocarbamidecobalt (III) nitrate interferes with linkage of ions W by oxygen, promotes its transition in a solution with formation of complexes, that, not giving an opportunity to be formed on a dissolved surface of metal passivation a film. That speed of anode dissolution of metal considerably increases.

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ELECTROPLATED COATINGS ON THE BASIS OF IRON ON STEEL AND WAYS OF INCREASE OF THEIR CORROSION RESISTANCE

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Были изучены два метода повышения коррозионной стойкости железа гальванических покрытий на основе железа: легирование медью, химико-термическая обработка. Было установлено, что легирование железных покрытий с медью ведет к изменениям в морфологии поверхностей; физико-механических, коррозионных и электрохимических свойствах. Коррозионные испытания показали, что образцы, покрытые железо-медным сплавом, подвержены коррозии в растворе NaCl в 1,4 раза, а в 0,05М растворе Na_2SO_4 – в 2 раза медленнее, чем у железных покрытий. Установлено, что нитрование железных покрытий делает слой менее пористым и обеспечивает более высокую коррозионную стойкость.

Ключевые слова: гальванические покрытия железо и железо-медь, нитрование, коррозия, потенциал коррозии.

It were studied two methods of increasing the corrosion resistance of iron-base electroplates: alloying the electroplates with copper, and through the thermochemical treatment of the electroplates. It was established that alloying the iron coatings with copper conducts to changes in the surfaces morphology, physicomechanical, corrosion and electrochemical properties. The corrosion tests have shown that samples, coated with the iron-copper alloy, corrode in the NaCl solution by ~ 1.4, but in 0.05 M solution of Na_2SO_4 – by ~ 2 times slowly than with the iron coatings. It is determined that at the nitration of iron coating the obtained conversion layer is less porous and provides a higher corrosion resistance. This is confirmed through he fact that corrosion potential moves in positive direction with 0.815 V in comparison with the 45 steel, which wasn't exposed to the thermal treatment, and with 0.448 V in comparison with the 45 steel, nitrided in the same conditions as the electroplate. Accordingly, the currents of anodic dissolution decrease with 3 and 4-5 orders.

Keywords: iron and iron-copper electroplates, nitration, corrosion, corrosion potential

1. Introduction.

The iron electroplates at sufficiently high mechanical characteristics do not possess sufficient resistance to corrosion in many aggressive media [1]. One of the methods for increasing the corrosion resistance is alloying of electroplates with copper through the coprecipitation of iron and copper on a metal support [2]. It is known that introduction of copper in the composition of iron alloys increases their corrosion resistance in different atmospheric conditions [3-5]. A considerable effect is already attained at the introduction in the steel of 0.1% of copper. This is explained by the formation on the corroding surface of a dense protective layer, under exposure to the atmosphere, and in the formation of which copper plays an important role [4]. Copper positively influences, inter alia, on iron passivation and increases the resistance of the passivating film to atmosphere corrosion.

However, the considerable difference between the standard potentials of copper and iron (with 0.76 V) embarrasses the electrolytic alloying process. Therefore, only in few works it is confirmed the possibility of iron-copper binary alloys deposition at the electrolysis of simple copper and iron salts [6, 7]. At the same time, the deposited electroplates have an insufficient adhesion with the support and a low microhardness, it becomes impossible their practical use. The powdery electrolytic alloys with fine copper-iron dispersion can be obtained at electrodeposition from simple salt solutions in the event of introduction in the electrolyte composition of surface-active substances [8, 9].

However, this method does not permit to obtain iron-copper electroplates with sufficiently high physical-mechanical properties.

The present paper is dedicated to searching a method for deposition from high-yield electrolytes, containing chlorides of deposited metals, on steel with medium content of carbon of iron-copper electroplates with good physical properties and resistant to corrosion, and it is also watched the improvement of said properties of the electroplates through the thermochemical treatment.

2. Experimental part

Deposition of the iron-copper coating was carried out from an electrolyte containing iron chloride and hydrochloric acid, wherein there was added copper chloride. The concentration of $CuCl_2$ salt was changed within the limits of 0.05 – 1.0 g/l. The limits of concentration were determined by the physical-mechanical properties of the iron-copper electroplates and by the electrolyte stability. The electrolyte composition, g/l: $FeCl_2 \cdot 4H_2O$ – 400.0; $CuCl_2$ – 0.05 – 1.0. As anode there were used steel plates with reduced content of carbon.

The electrolyte was prepared in the following way. In the acidulated water was dissolved $FeCl_2 \cdot 4H_2O$. The obtained solution was filtered and brought up to the required volume. Cleaning of electrolyte from Fe^{3+} ions was carried out by boiling the solution with iron-armco filings and subsequent electrolysis at the pH of 0.6-0.8, the electric current cathodic density of 20 A/dm^2 and the temperature of 60°C. The qualitative control of Fe^{3+} ions was carried out with the help of 10% KCNS solution and the quantitative one – by the volumetric method for titration of 0.05 N of ascorbic acid solution. And the pH was bought up to the required volume by adding hydrochloric acid. Then there was introduced the calculated quantity of $CuCl_2$ and the solution was mixed. The steel cylindrical samples had the diameter of 7-8 mm and the height of 10 mm and the plane ones – the dimensions of 10×10×3 mm.

For obtaining electroplates with high adhesion at base, the samples, after cleaning, degreasing with calcium and washing with water, were subjected to the anodic treatment in electrolyte for coating with iron at i_a = 50-60 A/dm^2 and the temperature of 60°C during 1 minute with subsequent washing in worm water at the temperature of 60°C.

For carrying out the electrochemical and corrosive comparative research there were prepared carbon-steel samples without thermochemical treatment and electrochemical coating, samples with steel coats containing copper and without it, after the thermochemical treatment and without it.

The chemical analysis of the electrolytes and coatings (the latter were dissolved in diluted hydrochloric acid) at the copper content was carried out by the spectrophotometric method of atomic absorption with the apparatus AAS-1. It was determined the copper content in the superficial layer of coatings with an analyzer with the ray fluorescence of X VRA-30.

The thermochemical treatment of samples plated with iron and without coatings was carried out in the anodic process in a solution containing 10% NH_4Cl and 5% NH_4OH at the temperature of 750°C during 5 min with subsequent cooling in electrolyte. The electrolyte volume temperature was of 30°C.

The electrochemical behavior of samples was estimated according to the potentiodynamic curves (4 mV/s), increased at the potentiometer P-5827 in the 20% H_2SO_4, 0.05 M Na_2SO_4 and 5% NaCl solutions. The potentials are given with respect to the normal hydrogen electrode.

The corrosive behavior of samples was studied by the method of complete immersion in 0.1 N Na_2SO_4solution at the test duration of 120 hours and intermediate removal of samples after 8, 24 and 48 hours. The microhardness of coats was measured with the microdurometer PMT-3 at the charges of 0.196 and 0.49 N.

3. Results and discussions

On the anodic potentiodynamic polarization curves increased in the sulfuric acid by 20% (Fig. 1, curves 3 and 4) on the steel samples 45 both with iron coatings and without them, there are observed zones of active dissolution and passivation. The first in both cases has the current bifurcated

maximum which possibly is bound by the existence of the local destructions of the superficial layer. The smaller density of the covering dissolution current compared with the base is possibly bound by its higher homogeneity and lower roughness (R_a = 1.8 μm instead of 2.5). The sudden current drop in the zone of 0.6 – 0.7 V is conditioned by the oxide passivation

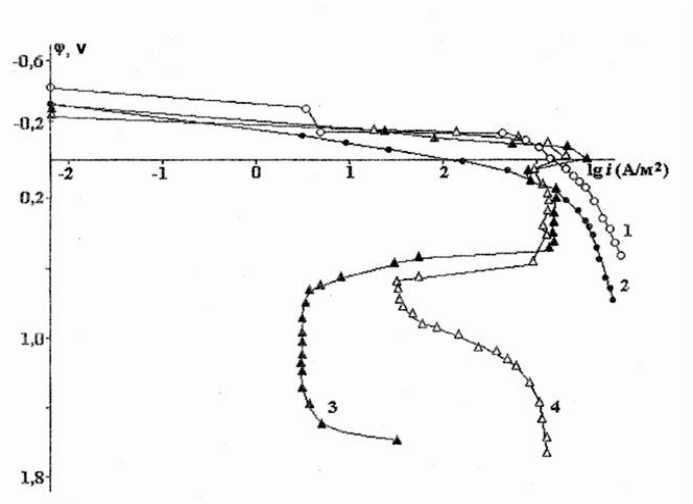

Fig. 1. Polarization curves (4mV/s of 45 steel without coating (1, 3) and iron coating (2, 4) in the solutions: 5% NaCl (1, 2) and 20% H_2SO_4 (3, 4)

The polarization curves of the steel samples ant coated with iron in the NaCl solution (Fig. 1, curves 1 and 2) are close in their form, but the second one is displaced towards the positive potentials and the smaller anodic dissolution currents. In the Na_2SO_4 solution that effect is amplified: the active dissolution current of the electrolytes coated with iron is decreased by the order 1.5 – 2; only attaining $\varphi \geq 0.8$ V the dissolution currents of all samples are equalized. Namely in this solution the iron coating the most strongly acts on the corrosion potential which moves in time in positive direction with 0.2 – 0.32 V. In the more corrosive NaCl and H_2SO_4 solutions the difference between the corrosion potential values of the coating and base is smaller.

The temporal reduction of φ_{cor} in the H_2SO_4 and NaCl solutions proves a certain activation; in H_2SO_4 φ_{cor} it is practically constant which tells about a high activity of electrodes from the very beginning. At the same constant potential of 0.1 V the iron coating reduces the initial anodic dissolution current in the Na_2SO_4 solution (tab. 1). At the free corrosion the losses of samples coated with iron (g/m^2) are smaller than in the NaCl solution by ~ 1.5 times (for 24 hours), and in the Na_2SO_4 solution – approximately twice (Tab. 2).

Table 1

Influence of sample exposure time on the initial anodic dissolution current in the Na_2SO_4 solution

Time, min.	**Current density , A/m^2**	
	Without coating	**With coating**
0	12,2	1,6
0,25	30,0	16,0
0,5	31,5	18,5
1,0	31,5	23,0
1,5	31,0	21,0
2,0	26,0	18,5
3,0	21,0	17,5
4,0	17,5	16,0

Table 2

Influence of sample exposure time on the corrosion loss (g/m^2) in different solutions

Samples	Solution	Time, hours				
		8	24	48	96	120
Without coating	NaCl	5,0	9,0	11,0	13,8	-
	Na_2SO_4	4,4	8,0	11,0	16,2	-
	H_2SO_4	0,5	1,4	2,45	5,55	7,0
With coating	NaCl	2,0	6,0	9,2	13,0	-
	Na_2SO_4	1,1	3,0	6,0	12,0	15,7
	H_2SO_4	0,75	1,25	3,1	3,3	3,7

In the H_2SO_4 solutions the corrosion loss of samples coated with iron are practically proportional with the exposure time and the 45 steel temporal corrosion intensifies, possibly, as a result of accumulation on the surface of iron carbides with the formation of microcouples.

Alloying of iron coatings with copper leads to changes both in the surface morphology and physical-mechanical properties. Increasing of copper content in coating leads to an approximately twice increase in the microhardness (Fig. 2).

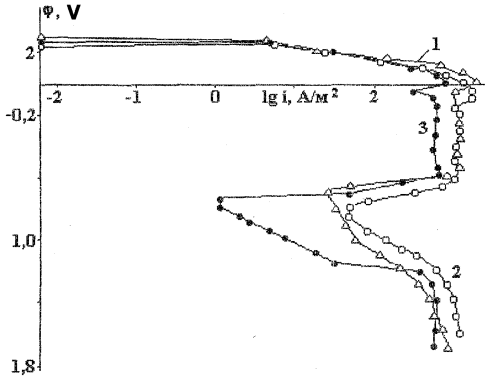

Fig. 2. Polarization curves (4mV/s) in 20% H_2SO_4: 1 – Fe, 2 – Fe+0,16%Cu, 3 – Fe+1,26%Cu

On the anodic potentiodynamic curves increased in H_2SO_4 by 20% the zones of active dissolution of iron and iron-copper alloys are close to each other. On alloys there are observed changes characteristic of iron in the course of curves. It should be mentioned that introduction of copper in the coating increases the corrosion potential and slightly decreases the anodic dissolution current in the active zone. In the iron passivation zone, where the copper dissolution velocity is of the order 10 A/dm^2 [10], the behavior of coating is determined by the behavior of both iron and copper (Fig. 2, curves 2 and 3).

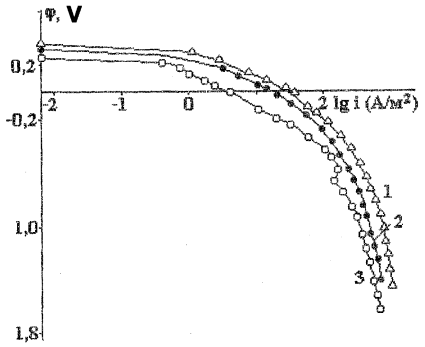

Fig. 3. Polarization curves (4mV/s) in 0.05 M Na_2SO_4: 1 – Fe, 2 – Fe+0,16%Cu, 3 – Fe+1,26%Cu

In the 0.05 M Na_2SO_4 solution the polarization curves of the iron-copper alloys are identical with the curve of the iron coating. With the increase of copper content in the alloy the anodic dissolution current almost along the whole length of the curve decreases, and φ_{cor} increases by 0.5 – 0.110 V depending on the copper content (fig. 3, curves 2 and 3). In the 5% NaCl solution (fig. 4) the anodic polarization curves of alloys and their dissolution rates slightly differ and are determined by the composition of iron. The corrosion potential of the iron0copper coatings is higher than of iron by ~ 0.80 – 0.120 V. Thus, the anodic dissolution of the studied alloys in the 5% NaCl solution in the potential interval from 0.200 up to +0.050 V takes place with a slight polarization; neither the iron nor the alloys passivate.

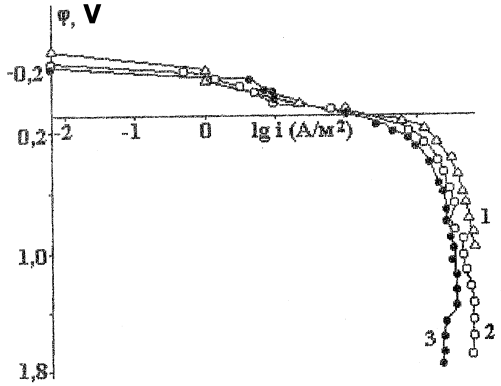

Fig. 4. Polarization curves (4mV/s) in 5% NaCl: 1 – Fe, 2 – Fe+0,16%Cu, 3 – Fe+1,26%Cu

The temporal potentiostatic change (at 0.3 V) in the anodic dissolution currents (A/dm^2) of the samples with iron (1) and iron-copper (3) coatings in the 0.05 M Na_2SO_4 solution is presented in Table 4. At the same time, the copper in the composition of iron coating slightly decreases its current of anodic dissolution.

Table 3

Influence of copper content in the coating on the microhardness of the sample surface (charge 0.196 N)

Number of sample	Copper content, %	Hμ, GPa
45 steel	0	2,60
1 (charge 0,49 N)	0	6,50
2	0,16	6,108
3	0,19	5,566
4	0,78	
5	1,26	3,205

Table 4

Influence of sample exposure time on the anodic dissolution currents at φ = 0.3 V

Time, hours	Sample 1	Sample 3
0	0,14	0,11
0,5	4,33	2,33
1,0	4,56	3,25
2,0	2,72	3,18
4,0	2,60	2,11

At the increase of copper content in the alloy from 0.19 up to 1.26% the dissolution rate decreases possibly by ~ 20% (from 274.5 up to 221.5 g/m^2·hour), that such behavior of the coating is explained also by the fact that as far as the alloy dissolves its surface enriches with copper.

The corrosion tests within 120 hours at the complete immersion of samples in solutions show that samples coated with the iron-copper alloy corrode in the NaCl solution by ~ 1.4, but in 0.05 M Na_2SO_4 solution – by ~ 2 times slower than with the iron coatings, judging by the kinetic similarity of the process, in both solutions the deceleration can be the result of enrichment of the superficial layer with copper. The copper, as it is well known, positively acts on the steel passivation and increases the action of protection of the superficial layer of products from corrosion [11], contributing to its compression.

The corrosion resistance of coatings can also be increased by the thermochemical treatment. From the data presented in Table 5 results that increase of the nitrated surface protection properties takes place due to the formation of the protective conversion coating containing iron oxides and nitrides [12].

At the nitration of iron coating, due to the greater homogeneity of the electrolytic iron, the conversion layer is less porous and, therefore, provides a higher corrosion resistance. This is confirmed by the fact that corrosion potential moves in positive direction with 0.815 V in comparison with the 45 steel, which wasn't exposed to the thermal treatment, and with 0.448 V in comparison with the 45 steel, nitrided in the same conditions as the electroplate. Accordingly, the currents of anodic dissolution of these samples, studied in 0.05 M Na_2SO_4 solution, decrease in going from 45 steel without thermochemical treatment to nitrided steel - by 3 orders, and of the 45 and 40X steels, nitided on the applied iron coating - by 4-5 orders. The data prove both a higher passivation property of the corresponding coatings and increase of the corrosion resistance in atmospheric conditions.

Table 5

Value of corrosion potentials and density of anodic dissolution current in 0.05 M Na_2SO_4 solution for the 45 steel with different treatment

Sample	φ_{cor}, V	I_a, mA/cm^2 at φ = +0,30 V
45 steel without coatings and thermochemical treatment	- 0,440	34,070
45 steel without coatings, nitrided	- 0,073	0,017
45 steel with iron coating, in the absence of $CuCl_2$ and nitrided	+0,255	0,010

Conclusions:

1. It was demonstrated that the iron coating, increasing the structural and chemical heterogeneousness of the superficial layer, contributes to the improvement of electrochemical characteristics of the steels in the corrosive media (φ_{cor} increases, the anodic dissolution current density and the corroded metal quantity decreases).

2. It is established that introduction of small quantities of copper in the composition of the iron-based electroplates or the thermochemical treatment thereof do not worsen the physical-chemical properties, but considerably increase at the same time their corrosion resistance in the atmospheric conditions and in the neutral media.

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NOOSFERA

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THE IMPACT OF THE GRAPES AND THE DERIVED PRODUCTS WINE ON THE HEALTH AND HUMAN ORGANISM

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Cultivation of the vine was only possible by the peoples with an sedentary lifestyle. During the development of civilization the agricultural activities, including wine, have generated and conditioned the development of different complementary specific crafts. Production of derivatives wine (grapes, raisins, wine, distilled, juices etc.) make the knowledge of production technologies and their storage, which requires a certain level of knowledge, technology and culture. The knowledge obtained were transmitted from generation to generation and also supplemented with new achievements and technological principles, thus helping to improve product quality grape and prolonging the periods allowed validity. Nutritional and therapeutic value of derivatives wine is known and used in medical practice since ancient times. Hippocrates in Ancient Greece and Iranian doctor Razes (864-926) at length used grapes and grape juice in treatment of many diseases internal and external. Ampelotherapy in the XIXth century, based on results achieved in medicine, biology, biochemistry, is applied widely in France, Germany, Italy, Switzerland, Crimea etc.

Keywords: grapes, derivatives wine, ampelotherapy.

Worldwide viticultural the assortment, currently contains over 12 000 species and varieties of vines, but so far has not been created variety "ideal" that brings the most valuable features:

color – golden-pink-red;

flavors – Muscat, citron, rose petals, violets etc .;

taste – harmonious crisp to varieties for fresh consumption, and balanced and juicy on the juice and wine.

Alongside these indices are indispensable the resistance to required biotic and abiotic factors of the environment, such as the low winter temperatures and the high arid summer drought, specific diseases of this culture – mildium, odium, botrytis and others, and various pests.

That is why, the current remain the problem of obtaining new varieties of vines agro-biological characters that caters to the maximum requirements for table grapes used to eating fresh and to those intended for industrial processing (juices, concentrates, wines, spirits).

The development of culture of the vine throughout of his evolution has multiple known methods to improve, such as the natural selection or directed (intraspecific, interspecific, clonal, genetic engineering, etc.).

A desideratum of the world science and practice winegrowing remains to be the of vines varieties obtaining quality, absolutely resistant to attack by phylloxera (root and leaf).

Process of obtaining the distant hybrids, as well as any cross varieties of *Vitis vinifera* L. with representatives from the donor species of qualities necessary (resistance to diseases and pests winter low temperatures etc.) can bring to the changing spectrum of chemical compounds and biochemical responsible for the aroma, color and taste of berries, juice and wine obtained.

According to the EU requirements in the production of wine products, the chemical composition of the raw material must meet some strict requirements, for example diglucozid-3,5-malvidol shall not exceed the limit of 15 mg/dm^3; methyl anthranilate (3,4-benzoxazole), represents a compound nitric benzoxazoles group, which has the main role in creating the taste and aroma, it is formed in grapes (especially direct producer hybrids) in quantities of 0,2-3,5 mg/dm^3 of must (juice).

That is found in the wine together the same concentrations of volatile aromatic another chemical component – amyl acetate. That is why this important chemical constituent of new hybrids berries juice intraspecific selection requires determined, studied and taken as a criterion for selection.

International Organization of Vine and Wine in 2004 has established the methanol concentration limit of 250 ml/l for white wines and 400 ml/l for red wines.

The methanol represents an alcohol, which is synthesized by substituting the methane molecule an atom of hydrogen, with a group – OH (hydroxyl). In the fermentation process of the fruit can be formed by the decomposition of pectin's methanol. Consumption of methanol can cause severe poisoning, it may arise in particular by the fraction distillation of alcohol.

The importance of the wine-derived products is known and used in medical practice since ancient times. Hippocrates in Ancient Greece and Iranian doctor Razes (864-926) at length used grapes and grape juice in treatment of many diseases internal and external. Ampelotherapy in the XIXth century, based on results achieved in medicine, biology, biochemistry, is applied widely in France, Germany, Italy, Switzerland, Crimea etc.

The biochemical and mineral content and the organoleptic properties of the juice from the berries and wine were important and beneficial action on the human body.

Prof. Prostoserdov N.N. (1948), one of the founders of the European School of uvology and oenology, filed general curative properties of grape juice and wine: taste and biliary action, bioenergy capacity, enhance the secretion of digestive function and determining optimal acid balance, improving elimination urine beneficial effect on the nervous system and vegetative etc.

Prof. M. Bourzeix (1982), prof. Roger Corder (2009), Acad. Valuiko G. (2007) demonstrated action to mitigate the toxic and harmful substances in the human body due bioactive of chemical compounds you have fresh juice and wine grape natural. For example, the presence of flavonoid compounds in wine significantly reduces the toxic action of ethanol impurities from ethanol, higher alcohols and aldehydes on the body. For comparison, in distillates strongly (vodka, brandy, grappa and wicker) these biologically active components are absent. Professor E. Scholz-Kulikov (1990) described a series of antimicrobial properties of wines. For example, in contact with the wine cholera embryos die in a few minutes, and the mixture of 50% to 50% water coming these vibrios perish during the first 30-60 minutes. Analogical effect was attested the case of typhus bacillus, tuberculosis and dysentery. The eminent oenologist M.M. Gerasimov, in his youth (at 27 years), in the Caucasus, was cured of tuberculosis in 60 days, each day consuming 200-250 ml dry red wine Cabernet. With this recipe success, the teacher shared the 83-year anniversary of his birth, stressing the important role of biologically active compounds in wine annihilation tuberculosis. French Professor Jacques Masquelier (1988) demonstrated that the bactericidal properties of red wine disappear immediately after removing from it the entire group of phenolic substances (especially bioflavonoids). It was marked bactericidal action and a series of acids of grape juice and wine: gallic acid, ferulic, hlorgenic and others.

The value of food and wine from grape juice is the sum of all components, such as sugars, organic acids, phenolic compounds, nitrogen substances, vitamins, trace elements, alcohol and others. French Dieticians in legislation, ranked wines from grapes that possess foodstuffs category, in most cases, curative, dietary and therapeutic.

The potential of nutritionally, or better said the energy of wine is determined by their physico-chemical composition, primarily of carbohydrates and ethanol. An liter of wine with amount of alcohol of 10-12% vol. Has on average 600-800 kkal (KDJ 2300-3000) and the amount of alcohol with 16-18% vol. – 1700 Kkal (7000 KDJ). The frenchman scientist T.Mirouse (1985) has calculated the for the first time the norm calories a day limit 130-240 kkal, which accounts on average 17-21% of the total calories received with food. In our opinion [Gaina, 2000], the daily consumption of grapes

berries, fresh and natural wines must ensure human organism with biologically pure water, high energy compounds (sugars, ethanol), organic acids and amines, so body needs, including irreplaceable vitamins of the group B (B2, B5 and B6), biotin (vitamin H), pantothenic and folic acids, mezoinozit and holin. Was determined that in the must and wine, grapes the solid particles of berries (peel and the seeds) are broadcasted significant amounts bioflavonoids (resveratrol, proantocianidoli etc.), which protects the whole group vitamins biochemical degradation or physicochemical.

The complex of vitamins from juice and wine exercise the function of regulator in the exchange of biocatalysts in the assimilation of components needed by the organism. Virtually all biochemical the constituents of the grape berries, juice and wine, most actively participates in the metabolism of substances exerting a beneficial action of nutrition assimilation in the processes. In this order of ideas, it is required to respect the strict condition of moderate wine of consumption (1-2 glasses per day, in dependence of the health status, body weight, physical load), accompanied by the vegetables, fruits, berries, nuts and food caloric. The wine stimulates the lust and enhances digestion processes. These data were confirmed experimentally by prof. Roger Corder US (The Wine Diet, 2009).

A natural wine for current consumption values due to proximity facilitates the digestion of food juices and of wines active acidity (pH 2.4 to 3.4) of gastric juice (pH 2.0-2.2). It is very important to eating fatty food and hearty. At the same time, under the action of pepsin and cathepsin enzymes intensifies the enzymatic protein degradation the processes, improving access by the blood the digestive organs. The results of numerous experiments have confirmed the opinion the French dietitians (T. Miró, 1985, J. Masquelier, 1988) that the toxicity of ethyl alcohol which contains the red wines diminishes due primarily phenolic substances (proantocianidoli, resveratrol, flavonols , anthocyanins etc). Currently, in the wines have been determined over 500 chemical compounds and biochemical the vast majority of which positively influences the metabolic processes in living organisms, which allows us to classify natural grape wines in the category of food and not just alcoholic beverages. The eminent physiologist I. Pavlov often accentuate tall the bioenergetic properties of the wine, highlighting their role in improving the state of the human body to overwork, physical weakness and lack of appetite after illnesses and operations. The first director of the School of Viticulture and Winemaking in Chisinau and the Moldovan mentor Peter Ungurean academician, Professor AM Frolov-Bagreev, pay special attention to the physiological effect of sparkling wines through their beneficial influence on the activity of the stomach, which is manifested through increased gastric acid secretion, increase appetite and improve digestion process. Frolov-Bagreev mention the formation of positive emotions and good mood after moderate consumption of these “spark drinks” as they called Russian the poet A.Pushkin.

Of organic salts of acids, tartaric, malic, citric, etc., whose concentration of Moldovan wines quality varies from 3 to 5 g/l, has a useful complex biological components, which causes excitation of the digestive tract and nervous system central. These salts effectively complement the body's the losses of these important elements of physical and intellectual efforts.

According to research, of ethanol the action of upon the human body is diminished considerably by the following components of the wine: proantocianidolii, especially their oligomeric forms (N.G. Arpentin, 1992), their derivates cahetinii in the Galata (G.G. Valuiko et al., 1994), resveratrolii (B. Chicken et al., 2007), glycine, and a series gamaaminouleic acid oligopeptide. The compounds mentioned above, in the known of mechanisms, shall exercise functions of collector of free radicals, which are the result of oxidation of ethanol and other alcohols.

At the same time, takes place the activation of enzymes alcohol dehydrogenase (ADH), catalase (Ct) and the system microsomal ethanol oxidation (MOC) under the action of glycine, glucose and succinic acid. The same time the active coupling of takes place to partial oxidation of the products of

ethanol, methanol and other alcohols in the number of constituents: acetic and formic aldehyde, acetate esters, etc.

Moderate consumption of red table wine in elimination of human body tension and stress when after him.

The compounds of the antialcoholist of wines stimulates the the activity of enzymes responsible for metabolism of ethyl alcohol. These enzymes are alcohol dehydrogenase, aldehyde dehydrogenase (ALDH) and microsomal etanoloxodativă sistema. It has been found that a low activity of dehydrogenases increase in the concentration of the aldehydes takes place in the body, which causes "hangover syndrome" and, at the same time, low alcohol tolerance. Determining the level of activity in the human blood A1DH is necessary in all cases where problems arise with alcohol consumption. In these and other cases (cerebral commotions, the liver damage by the viruses, pancreatic crisis and others) we recommend fresh and dried berries, the grape-vine, black currant, mountain ash, plums, blackberry, raspberry, strawberry and more. They are appreciated as very useful juices from fruits and berries homogenised above and shaped their consumption fresh frozen and preserved.

For the first time it was established the beneficial influence of phenolic compounds, which are contained in large quantities in fruits and berries, especially their drinking fresh concomitantly with the administration of alcoholic beverages - reduces the action of of alcohol on the human body. And if this decrease is insignificant in the first 15-20 minutes, then after an hour a decline eforiei strong and an increase in self-control. An antialcoholic particularly positive effect they have the table grapes from varieties Moldova, Coarna Neagra, Codreanca (Black Magic), etc. Muscat de Bugeac as well as fresh juices obtained (after maceration on the pomace), varieteis of Codrinschi, Negru de Ialoveni, Saperavi , Merlot, Cabernet, Gamay Freaux, Golubok etc. Concentrates from red grape varieties (65-68% Brix), diluted to 15-17% sugar content, possess important actions to mitigate undesired effects of consumed alcohol upon the human body, primarily the liver, pancreas and digestive tract [66].

The researches of doctors and scientists french oenologists (J. Maschiulier, 1992 S. Reneau, 1994) have allowed to determine the some outstanding properties of polyphenolic compounds: suppression development of malignant tumors in animals (resveratrol, quiercetin and compiferolii), antimutagenic activity (proantocianidoli), antiviral (oenotanine), bactericidal (3,5-malvidina diglucozid acid, p-cuinaric). Thanks to these properties of the polyphenolic compounds of the grapes, juices and of wines manifests itself universal the therapeutic action on the human body.

The fundamental properties of the polyphenolic substances of the grapes, especially the red varieties, and the products of the process are manifests through the suppression of free radicals responsible for a host of pathological conditions of the human organism: infection and inflammation disorders, alcoholism, cancer, ischemia and premature aging. The free radicals are responsible for environmental pollution when contaminating water, air and food. They contribute to the impairment of the cardiovascular system and cause lower blood pressure and atherosclerosis. The free radicals it also causes premature aging of brain cells, worsening the central nervous system activity.

With the age, the activity of antioxidant enzymes in the human organism decreases. In this connection, a beneficial effect is consumption of foods rich in antioxidants such as polyphenols (resveratrol, proanthocyanidins, etc.), beta-carotene, vitamins C and E, selenium and zinc.

The professor J. Masquelier (1992) established experimentally that the human organism antioxidant activity of grape polyphenols totality is 25-30 times higher compared to vitamin E and polyphenols from red table wines - 50 times. In comparison with the fresh grapes and grape must from which absorption in the organism is an average phenolic substance, alcohol wine polyphenols dramatically magnifies the bowel passage into the bloodstream, accelerating and amplifying the effect of protecting human organism from free radicals.

Our conception regarding use of the products from grapes, rich in freely radical scavengers in the fight with atherosclerosis, consists in the use fresh grapes and fresh juices obtained from the red varieties (grapes or wine) instead of table wines, then when there are medical contraindications in connection with hepatitis, pancreatitis, ulcers, cerebrovascular trauma. In this case, although is slower than the wines takes place polyphenols and other antioxidants absorption of consumed the fresh grapes or grape must, obtained after 6-9 hours of maceration of the pulp in order to enrich the biologically active compounds. The large number of grapes and must of fibers (pectin/protopentină, arabinogalatan, cellulose, etc.) reduces the absorption of saturated fats in the intestine, reducing the risk of atherosclerotic disease.

Based on studies carried out, the following results have been obtained regarding resveratrol content in the products mentioned above, the grapes and wine obtained after maceration in the must in a natural way of the pulp quantity of resveratrol vary from 4,5 mg/dm^3 to 7,2 mg/dm^3, while the wine – only 2,1 mg/dm^3 to 3,2 mg/dm^3. Pectinases enzymatic action of the compounds, Cx-enzymes, proteases betaglucozidatelor and the pulp, with maceration for 5-7 hours, allowed extracting from the skin of berries red table grape varieties Moldova, Codreanca Coarna Neagră and varieties for wine Golubok, Negru de Ialoveni, Saperavi and Merlot to 12,0 to 13,6 mg/dm^3 of resveratrol. At the same time, the concentration of the phenolic compounds increased the amount 1,5 times with virtually no increase in oxidized and condensed.

Our conception, based on research carried formulated, consists of replacing of wines and other alcoholic beverages of fruit (macerated, conditioners etc.) with natural extracts from grape peel and pips. One of it is oenoconcentratul 25% developed and implemented for production in Moldova by savants B. Chicken, V. and C. Căldare Bodean (2009). The company "Eurofarmaco" S.A. produces similar substances in grapes – "Vitagrapes" and French scientists have elaborated on the basis of polyphenols (including from grapes) preparation "Endotelon", who conquered the world market.

National Institute of Vine and Wine "Magarach", Yalta, Ukraine obtained and produced concentrate of polyphenols "Enonin", which are widely used in contemporary medicine.

Currently is well known "the french paradox", named americans, because the mortality from myocardial infarction in French is 3,5-4,0 times lower in comparison with the same index in the US, taking into consideration that the amounts of fat consumed in these countries are equal. French people consume more unsaturated fats the Americans - mostly saturated, and in France they drink 3-4 times more wine than in North America, where it consumes whiskey, tequila, etc. This correlation between power rational and beneficial way of life is called "mediterranean paradox".

From our point of view, no significance what it's called this important therapeutic effect and where he seized hold. It is important the concept. This consists of the daily consumption by humans with food, the natural antioxidants, which have a considerable effect of reducing the concentration of free radicals. Also, it is very important to reduction of consumption of saturated fats rich in oxidized LDL lipids that have atherogenic action.

In this context, we conclude that the grapes vines rich in antioxidants and other red fruits and berries eaten fresh or thawed, along with red table wines, are undoubtedly important factors that paradox that man gives unique opportunities for health and long life.

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THE IMPACT OF AUTOMOTIVE TRANSPORT ON THE AIR QUALITY IN NORTHERN MOLDOVA PLATEAU

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The present article contains a study on the impact of automotive transport on air quality in Northern Moldova Plateau. This article reflects the dynamic aspects of the volume of pollutants regionally emitted with some territorial issues.

In preparation for this article were used statistical data provided by the State Environmental Inspectorate and the National Bureau of Statistics. The scientific publication also describes some current issues regarding the impact of automotive transport on air pollution and ways of sollution.

Key words: *automotive transport, pollution, pollutants, ways of sollution*

The quality of air is now largely driven by the intense flow of automotive transport, which became the main source of air pollution. Due to automotive transport development is intensifying its influence on the environment and human health, it is therefore necessary to implement some measures to address this problem.

Results and discussions

Over the past few years, the main cause of air pollution in Northern Moldova Plateau is the automotive transport. During the years 1995-2014, the volume of emission of pollutants into the region increased from 0,2 thousands of tonnes in 1995 to 10,6 thousands of tonnes in 2014.

The dynamics of the volume of pollutants emitted by automotive transport in Northern Moldova Plateau is reflected in Fig. 1.

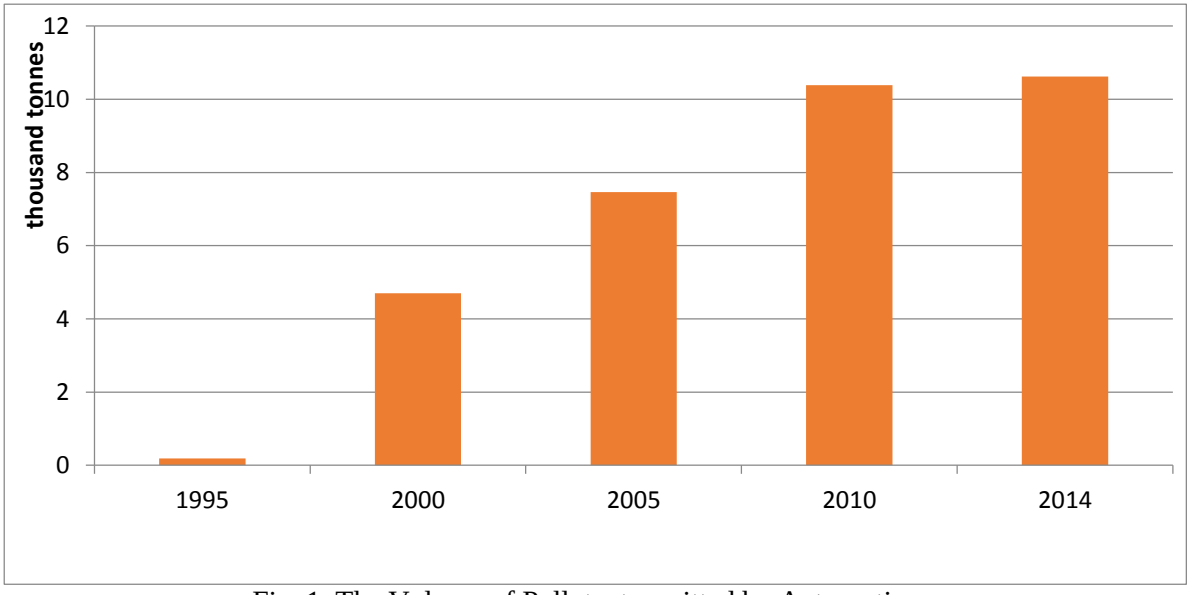

Fig. 1. The Volume of Pollutants emitted by Automotive Transport in Northern Moldova Plateau [6, 7, 8, 9]

Nowadays, the share of automotive transport rose to 90.2% of the exhaust emissions of pollutants in the study region. The spatial distribution, the maximum volume of emissions is registered in Edinet (6100 tonnes) and Briceni (4.5 tonnes), while in the share of pollutants prevails carbon monoxide (fig. 2).

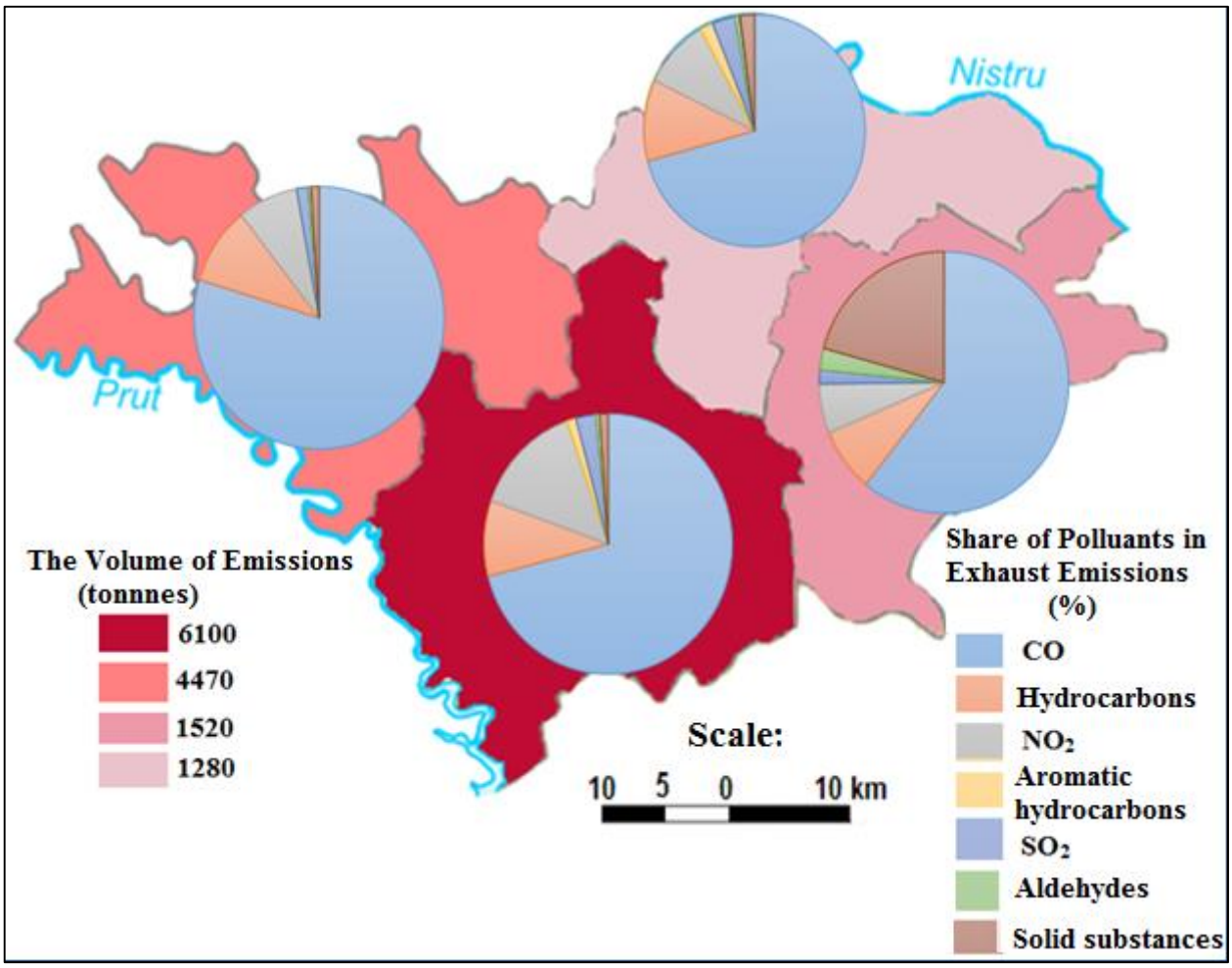

Fig. 2. The Volume of Emissions and Share of Pollutants in Exhaust Emissions in Northern Moldova Plateau (on administrative territorial units) (average of the years 2010-2014) [2, 3, 4, 5, 9]

The increasing trend of exhaust emissions from automotive transport in Northern Moldova Plateau is caused by the increase of recorded means of transport, and according to statistics their number has increased from 30 200 units 1990 to 62 300 units in 2015 (fig. 3).

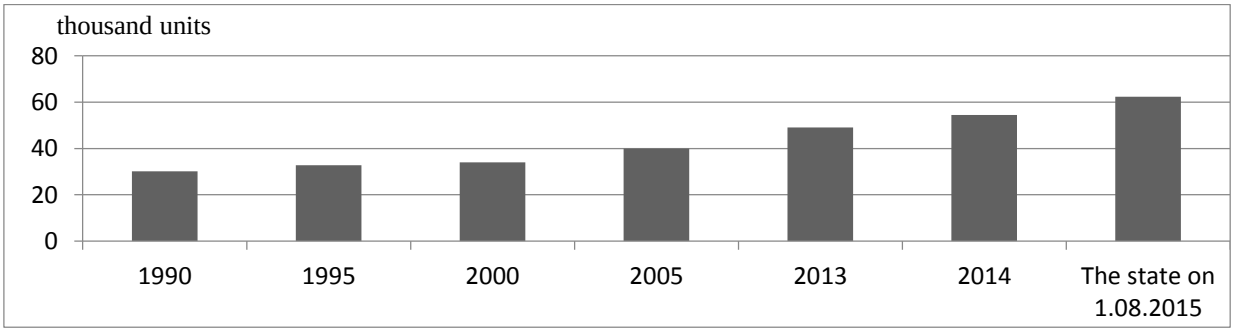

Fig. 3. Means of Automotive Transport (with environmental impact) recorded in Northern Moldova Plateau [7, 8, 10]

According to SE "CRIS Registration" in the structure of recorded transport in Northern Moldova Plateau prevailing cars, which have a share of about 55.6% (fig. 4).

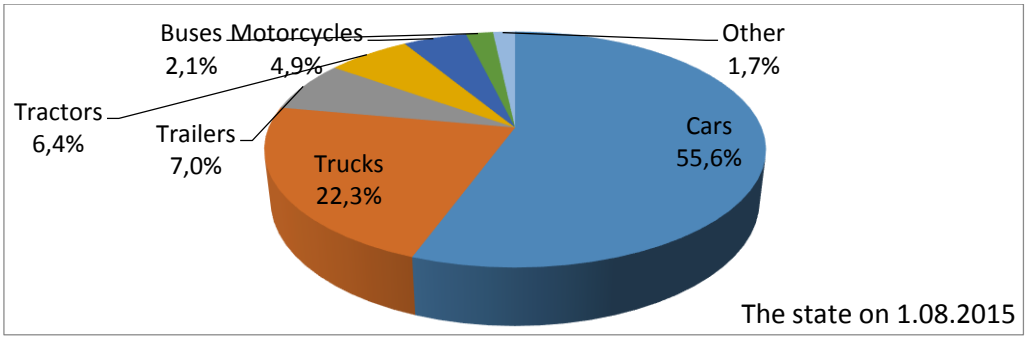

Fig. 4. Means of Automotive Transport Recorded in Northern Moldova Plateau [10]

A cause influencing the increase in the volume of emissions from mobile sources is the old car park in the region and according to data from the State Ecological Inspectorate the share of vehicles aged over 20 years has reached 50% (fig. 5).

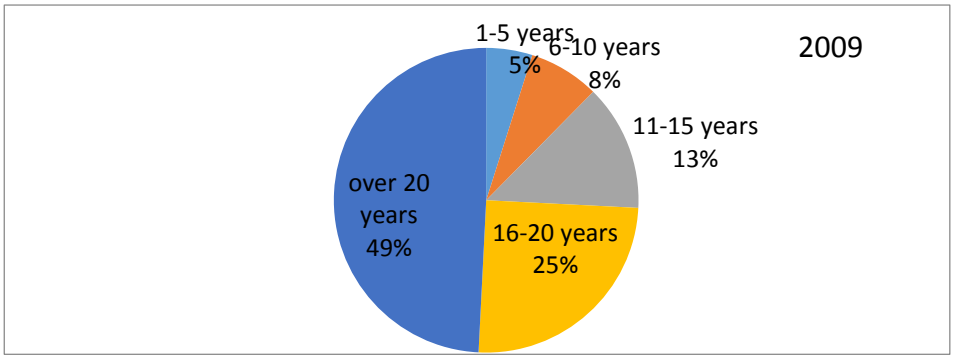

Fig. 5. The Characteristics of automotive transport by age in Northern Moldova Plateau (%) [1]

According to the State Ecological Inspectorate this situation exists because previously the country were imported second hand vehicles (up to 10 years), also in the process of their primary registration it is not taken into consideration the requirements of ecological safety insurance according to environmental enforcement duties.

According to statistics in the structure of pollutant emissions from mobile sources predominate carbon monoxide, which emissions increased in the structure of exhaust emissions from 0,3 thousands of tonnes in 1995 to 8.1 thousands of tonnes in 2014, exceeding the emission of other pollutants taken together (fig. 6).

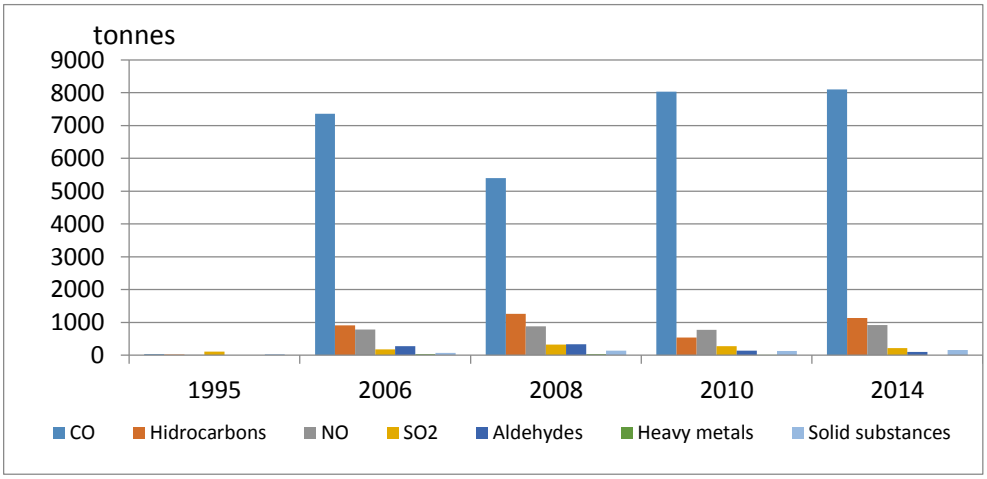

Fig. 6. The Dynamics of Pollutant Emissions from Automotive Transport in Northern Moldova Plateau [6, 9]

In the structure of pollutant emissions are also highlighted insignificant emissions of hydrocarbons and nitrogen oxide. The vehicles also emit small amounts of toxins and carcinogens (benzene and aldehydes).

Conclusions:

1. The research shows that the main source of air pollution in Northern Moldova Plateau is the automotive transport, which share constitutes about 90% of exhaust emissions.
2. Generally, the automotive transport in Moldova has become the biggest source of pollution for the environment within the study area due to increasing number of vehicles and the increasing number of motor vehicles operating within more than 10 years.
3. The structure of pollutant emissions from automotive transport prevails carbon monoxide emissions, hydrocarbons and nitrogen dioxide, which play an important role in the mechanism of the manifestation of the greenhouse effect.
4. In order to reduce the air pollution in Northern Moldova Plateau, in the future would be necessary to use electric transport in the largest urban centers from the region (Edineţ, Cupcini, Briceni, Ocnita), to limit the import of motor vehicles with the operating period higher than 7 years, to use in automotive transport fuel as unleaded petrol and diesel with low sulfur content.

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PLANT PROTECTION PROBLEMS IN ECOLOGICAL AGRICULTURE

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Parting from the aggravation of ecological situation and taking into account the achievements in the field of biological plant protection, in the Republic of Moldova consistent measures have been undertaken in the direction of ecological agriculture promotion. The main legislative documents (Low No 115 from 2005 concerning the ecological agriculture, Government decision No 149 from 2006 concerning its implementation, a series of regulations) have been adopted. The results relative to production organization, processing and marketing of ecological products are being registered, but a series of the technological problems remains which are waiting their solution. They discussed the main achievements in this area.

Keywords: Conventional agriculture, organic farming, ecology, entomophagies, biological preparations, biologic active substances, technology.

Introduction

Modern agriculture relies on the most innovative science to maintain a careful balance of farm inputs and potential impacts on the environment. Conservation tillage, integrated pest management and crop rotation focus on precision and sustainability without sacrificing crop yields. Farmers today use different practices to reassign economic effectiveness, protect human health and environment. Scientific research and massive investment in modern agriculture during the past 50 years has helped farmers to increase food production. New technologies help farmers to use precise applications and fewer inputs, leading to increased productivity and higher yields. Among them a special place occupies application of chemistry [1].

A pesticide, as a chemical compound used to control weeds, plant diseases or insects. Since pesticides may be harmful to humans, animals, or the environment, it is important to understand the fate of pesticides after application. In connection with the adverse impacts of pesticides people throughout the world are interested in organic or "naturally produced" foods. However, although similar in principle, growing crops or producing animal food or without use of pesticides is different from “organic” farm production. Legally, there are steps that growers must follow before the word “organic” can appear on the label.

Overestimation of productivity of crops during the period of “green revolution” has led to the underestimation of soil fertility. Higher level of yields could be maintained with higher rates of inputs and higher yield potential of the new varieties and hybrids of crops, but in the same time with decreasing level of soil fertility. The humanity became in the face of dilemma – how to increase the production in order to cover the increased demand of people in food products and in the same time how to avoid the increased degradation and pollution of the environment. This led to the Rio world summit in 1992, where for the first time at the international level it was declared that new ways of intensification, including in agriculture have to be found in order to provide sustainable development [3].

Conventional growers use pesticides, fertilizers, genetically engineered organisms and growth enhancers to stimulate their soil and crops. Typically, the health of the soil is of secondary importance compared to gaining strong short-term crop yields. If the soil is found to be lacking or depleted in nutrients, synthetic fertilizers are added. Crops may be grown from genetically engineered seeds and pesticide usage is allowed to control crop pests. Conventional farmers can also use manure without restrictions and are not required to keep records of their production practices [6; 19].

Organic farming (ecological agriculture) is a completely different system from conventional farming. Over the years, organic farming has become defined very simply as a practice that does not

use synthetic pesticides or conventional chemical fertilizers, but organic farming involves much more than this [2].

Now, organic farming is more popularly known for what it is not. Conventional agriculture is far more widespread, so let's first take a look at the conventional process in order to better understand the differences that distinguish organic farming from other agricultural systems [4; 23].

Ecological agriculture is a system which avoids or largely excludes the use of synthetic inputs (pesticides, fertilizers, hormones, feed additives etc.) and to the maximum extent feasible relies upon biological protection, crop rotations, animal manures, mineral grade rock additives and biological system of nutrient mobilization. Organic farming is a method of crop and livestock production that involves much more than choosing not to use pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones [17; 11; 12].

The general principles of organic production include the following:

- protect the environment, minimize soil degradation and erosion, decrease pollution, optimize biological productivity and promote a sound state of health,
- maintain long-term soil fertility by optimizing conditions for biological activity within the soil,
- maintain biological diversity within the system,
- recycle materials and resources to the greatest extent possible within the enterprise,
- provide attentive care that promotes the health and meets the behavioral needs of livestock,
- prepare organic products, emphasizing careful processing, and handling methods in order to maintain the organic integrity and vital qualities of the products at all stages of production,
- rely on renewable resources in locally organized agricultural systems.

Taking into account the negative phenomena of conventional agriculture and to ensure permanent progress and lengthy agriculture, which must remain in harmony with nature, the world has consolidated the International Federation of Organic Agriculture Movement (IFOAM). Over the past few years have been crystallized and the main requirements for organic products, which are currently classified in EU Regulation no. 2092/91 of 24.06.1991 [20; 23]. To improve process improvement activities in organic agriculture since 1 January 2009 new regulations were approved (no. 834/2007 and no. 889/2008), which references to Directive 2092/91 were automatically taken over by no. 834/2007 [19; 20].

Although serious premises are known to promote green technologies, however, the results have been modest, which requires further research to ensure scientific and technological strategy for implementing this kind of activity.

Material and Methods

Isolation, identification and determination of biological strains of baculovirus, bacteria, fungi, actinomicetes and entomopathogenic nematodes were performed by applying optical and electronic microscopy, production and application of biological means of plant protection. The efficiency of viral preparations was determined Abbot Formula, which provides natural insect mortality [19].

The establishment of biological protection systems applying bacterial preparations, baculovirus and fungal entomopathogens, biologically active substances, including sex pheromones has been carried out on the systems of pest forecasting development [25].

Testing in laboratory and experimental group means, methods and conventional and organic farming systems was conducted in four randomized repetitions in accordance with the general requirements of experiences of this kind [20; 24; 22].

Rezults and Discutions

The plant protection and worsening environment

The losses of crop production caused by various species of pests, pathogens and weeds is 25-30%, and with the development epiphytotic disease and pest and weed invasion vertiginous, crop losses exceed 50-60% or compromise the overall majority crops [20].

Conventional agriculture based on intensive application of various chemical means, especially pesticides, solved one of the global problems of humanity, that of ensuring food. Taking as a basis the broad application of genetic science achievements and progress in the field of applied chemistry, it contributed aim at improving the living conditions of man. But against the backdrop of the impressive achievements of traditional agriculture are obvious and negative phenomena of the medals [5; 20].

The role of pests that reduce the crop factor greatly increases amid flagging attention on plant health and crop land and diminishing control of plant protection activities. It attests increasing negative impact of plant protection measures and environmental protection requirements [16; 14].

While reducing the ravages caused by harmful organisms, pesticides causes serious disturbances in the ecological balance, greatly reducing the number and role of flora and fauna useful and their application prolonged cause various genetic changes, including the emergence of resistance to pesticides that conditions need to increase the dosage and the number of treatments in controlling pests. Record the potential negative phenomena in human population, which results in reduced awful people age, decreased immunity, increased mortality and morbidity of the population. The requirements for the organization of plant protection measures are in permanent conflict with the requirements of environmental protection and human health [19; 20; 22].

Alternative directions in plant protection

The research ecosystem have shown that the deepening impact of plant protection and the environment can be stopped only at the development of agriculture as a body as a living ecosystem, which has its model in nature, which is an alternative to intensification, specialization and dependence full to chemicals and pesticides. It is directed harmonious not cause any damage agricultural ecosystems environment in which they evolve in accordance with the national laws of development of the biosphere [7; 23].

Integrated plant protection measures is a technological block in technological maps and crop farm, which lies in the dedication of plant protection based on the biocenotic principles. Operation integrated protection is not just mechanical joining methods and chemical protection is not just alternating different sources of protection is not a simple change of chemical means other, but deep restructuring includes the concept of plant protection.

Wide systemic research approach involves the integration of knowledge from different sciences such as Phytopathology, entomology, microbiology, ecology, virology, biotechnology, etc., which are largely related to plant protection. Apart from direct relationships, indirect links integrated plant protection is particularly huge and include knowledge related to biology, cultivation, economy, healthcare. Namely systemic approach has enabled to realize that plant protection include a number of specific systems that interact and function as a whole, thus emphasizing the direction of solving practical problems by using process modeling methods, which take place in agrocenoses.

Organic farming as a flexible complex of measures called to ensure optimum protection of plants over a long period of time, meeting the requirements of sustainable development of society. On the basis of agro knowledge they stand as a functional unit of the biosphere and is not geared to combating a certain species of harmful organisms, but to control the entire complex of harmful organisms that once culture. In order to reduce the ravages caused by harmful organisms is to be used natural factors, which greatly limits the potential density and damage caused by them [10].

The application range of knowledge about immunity and resistance of plants to pests and diseases, biotic and abiotic factors that act on harmful organisms, introduction and acclimatization beneficial organisms allow greatly reduce the population density of pests such an extent that damage to them does not exceed the economic damage. We support the use of different measures, called the constitutional, which provides adjustment of population density and establishing useful agents in agro ecosystems. In conditions when applying these measures do not provide the desired effect, propose corrective measures that reduce population density of pests to economically tolerable level. When

applying corrective measures are taken into account not only the results close, but subsequent follow-up, more distant.

Organic farming involves more administrative costs than conventional farming. Being certified organic involves quite a bit of regular record keeping, detailing the strict records of their growing practices.

The majority of studies claim no difference in the nutritional content of organic food from conventional food. Keep in mind that the methodology for all of these studies looks at the nutrients contained in the food – vitamins, minerals, proteins, etc. If you factor in the use of chemical fertilizers, pesticides, hormones and antibiotics as part of the equation, organically grown food will come out as more nutritious and more healthful every time.

Organic farming promotes the use of crop rotations and cover crops, and encourages balanced host/predator relationships. Organic residues and nutrients produced on the farm are recycled back to the soil. Cover crops and composted manure are used to maintain soil organic matter and fertility. Preventative insect and disease control methods are practiced, including crop rotation, improved genetics and resistant varieties. Integrated pest and weed management, and soil conservation systems are valuable tools on an organic farm. Organically approved pesticides include "natural" or other pest management products included in the permitted substances list of the organic standards [13].

Biological protection – the foundation and part of organic farming

From new methods of pest control are the most effective biological that the current concept would be more correct to name as their density routing methods through biological agents and comprise a broad spectrum of processes. These include the introduction and acclimatization of new areas of biological entities, mass production and launch seasonal agrocenosis protected [19; 20]. This is a system for regulating population density of pests, taking into account the specific environment and their dynamics, using natural mechanisms and entities useful adapted to maintain the populations of pests and pathogens below the economic damage, ensuring economic efficiency and environmental.

Enhancing the efficiency of biological protection can be achieved in the phytosanitary situation of the protected-culture knowledge, biology capabilities pest and biological agent. Addressing Plant Protection and Development of the production of organic products can be achieved when applying main groups of biological agents: entomophages, biological products (viruses, fungi and bacteria) and biologically active substances, first sex pheromones [20; 11].

Given the fact that the mechanisms regulating natural ecosystem is determined by complex relationships between components lower levels of organization of living matter (the consortional systems and food chains), which can be searched in accordance with existing methods, it is obvious that investigations natural ecosystem in order to determine mechanisms of adjustment can be made only in the food web. It is necessary to research the relationships that are falling species enlightening plant and phytophagous specialized as species polyphagous and oligophagous pests do not determine the status circuits of substances, but only serve as elements of doubling the mechanisms of transformation of matter and energy. Therefore in order to develop models and plant protection systems necessary to detect natural ecosystem regulation naturally mechanisms or less modified under the influence of anthropogenic factors.

As an indication main selection means of plant protection do not have to use the degree of destruction of the pest, but the elimination phytophagous during the whole ontogenetic and taking into account the phenomenon of post action over several years. The persistence of biological agents within agrocenosis demonstrates that these is extracted from natural conditions, and then apply in order to protect plants become artificial analogs of natural compounds regulating density populations of harmful organisms.

The aim of natural control is to restore a natural balance between pest and predator and to keep pests and diseases down to an acceptable level. The aim is not to eradicate them altogether.

Pesticides do not solve the pest problem. In the past 50 years, insecticide use has increased tenfold, while crop losses from pest damage have doubled. Here are three important reasons why natural control is preferable to pesticide use [13].

Pesticides can quickly find their way into food chains and water courses. This can create health hazards for humans. Human health can also be harmed by people eating foods (especially fruit and vegetables) which still contain residues of pesticides that were sprayed on the crop.

There are a number of harmful effects that chemical pesticides can have on the environment. Pesticides can kill useful insects which eat pests. Just one spray can upset the balance between pests and the useful predators which eat them. Artificial chemicals can stay in the environment and in the bodies of animals causing problems for many years. Insect pests can very quickly, over a few breeding cycles, become resistant to artificial products and are no longer controlled. This means that increased amounts or stronger chemicals are then needed creating further economic, health and environmental problems.

Development of Ecologic Agriculture in the World and Republic of Moldova

In response to environmental actions, in 1972, in Versailles was established IFOAM who managed to promote organic farming and currently meets approximately 1,000 members in 170 countries. The main results of the latest survey on certified organic agriculture world-wide show that 43.1 million hectares of agricultural land are managed organically by 2 million producers. The regions with the largest areas of organically managed agricultural land are Oceania (17.3 million hectares or 40% of the global organic farmland), Europe (11.5 million hectares or 27% of the global organic farmland) and Latin America (6.6 million hectares or 18%).

On a global level, the organic agricultural land area increased by 6 percent or almost 6 million hectares compared with 2012; mainly due to a major increase of organic land in Australia. The countries with the most organic agricultural land are Australia (17.1 million hectares), Argentina (3.2 million hectares) and the United States (2.2 million hectares). The highest shares of organic agricultural land are in the Falkland Islands (36.3 percent), Liechtenstein (31.0 percent), and Austria (19.5 percent). The countries with the highest numbers of producers are India, Uganda and Mexico [21].

As of the end of 2013, 11.5 million hectares in Europe were managed organically by more than 330000 farms. 2.4 % of the European agricultural area is organic. Twenty-seven percent of the world's organic land is in Europe. The countries with the largest organic agricultural area are Spain, Italy, France, and Germany. There are eight, countries in Europe with more than ten percent organic agricultural land: Liechtenstein, Austria, Sweden, Switzerland, Estonia, the Czech Republic, Latvia, and Italy. Compared to 2012, organic land increased by 0.4 million hectares and the European market size was 24.3 billion Euros.

As organic moves beyond a niche, the organic movement needs to take stocks of what organic has become and what the future holds for us all. The movement needs to be prepared to cope with future political developments, environmental challenges and market trends. IFOAM EU initiated a participatory vision process to prepare the movement to proactively face the future [13].

In Republic of Moldova to achieve these goals were taken some measures sparse, which did not allow this movement to grow. It should be mentioned that it is known for some favorable conditions. Besides the achievements already made towards the development and application of biological methods of plant protection, the primary basis for obtaining organic products were taken a series of measures aimed at obtaining, processing and marketing of organic products.

It is worth mentioning that in terms of production achieved, organic agriculture and responding to the objects particularly important for Moldova, as for example:

- Meet the growing domestic and foreign natural products, which clearly demonstrated the contribution to maintaining and improving the health of humans and animals;

- Considerably diversified range of product categories in the market is in a state of overproduction and increasing the volume of crop production values appreciated at the moment we value;
- Facilitates the production activity of native farm out the lack of competition on the foreign market for some vegetables and fruits that have optimal conditions for the application of technologies for organic products;
- Material interests prices farmers through organic products exceeding 1.5-3 times the conventional prices, although there has been a 15-20 percent decrease in production volume;
- Enhances the quality of biological, biochemical and nutritional organic products. Given the fact that organic products are not a result of industrial processes, the consumer chooses the criteria morphometric but after their biological value;
- Strengthen opportunities for agricultural producers to enter the western market for agricultural products, which is highly conventional and competing products show particularly high requirements for organic products.

Namely in this way can we hope to stop the processes of ecological crisis and maintain the natural dynamic balance. Application technologies for organic farming are resulting in products with high biological value, healthy, pesticide-free and high-quality content.

The new paradigm of sustainable development in agriculture is based on respecting the following principles:

- minimization purchased artificial inputs from outside of the farm and avoiding them completely in organic agriculture,
- intensive use of renewable sources of energy mainly of local provenience,
- a more complete energy and nutrient recycling,
- minimization of the negative impact on the environment,
- utilization of local, more adapted varieties and hybrids of crops, a higher biodiversity of crops,
- restoration of soil fertility, which is determining the vitality and the health of soil, crops, animals and people,
- equity in relationships between producers, processors, distributors, sellers and buyers.

Republic of Moldova has the legislation in this aspect, harmonized with the European and international requirements which includes:

- the national concept on ecological agriculture and the action plan for the implementation of this concept, adopted by the Governmental Decision no 863 from 21.02.2000,
- the Law no 115-XVI from 09.06.2005 regarding the ecological production,
- the Governmental Decision no 149 from 10.02.2006 regarding the implementation of the low on ecological production.
- the Government Decision no. 1078 of 13.10.2008 "Technical regulations for the implementation of Regulation EC 834/2007 on organic food production, labeling and control".

In order to respect these principles we should return to holistic (system) researches instead of reductionist ones. Improvement of technologies isn't enough for achieving a more sustainable development and especially for organic farming systems. Changes for the whole farming system are necessary which show the multifunctional role of agriculture. We need to develop self-sufficient and self-regulating production systems, which are less dependent from artificial, industrial inputs, can use more efficiently local resources and are friendly to the environment [9].

Researches have to be undertaken for the whole food chain – from crop breeding, primary production by farmers, processing, marketing up to consumers. By saying this we mean to take in consideration not only the production sector, but also the environment and social sectors. In other

words, the whole link should be in the attention of researches – from the fork up to the table of consumers.

Vigorous actions taken in Moldova have allowed the institutionalization of this field of activity, increase activities within the agricultural producers interested in promoting organic agriculture, approval of the National Label "Organic – Moldova" and the recording of significant indicators (fig. 1-3).

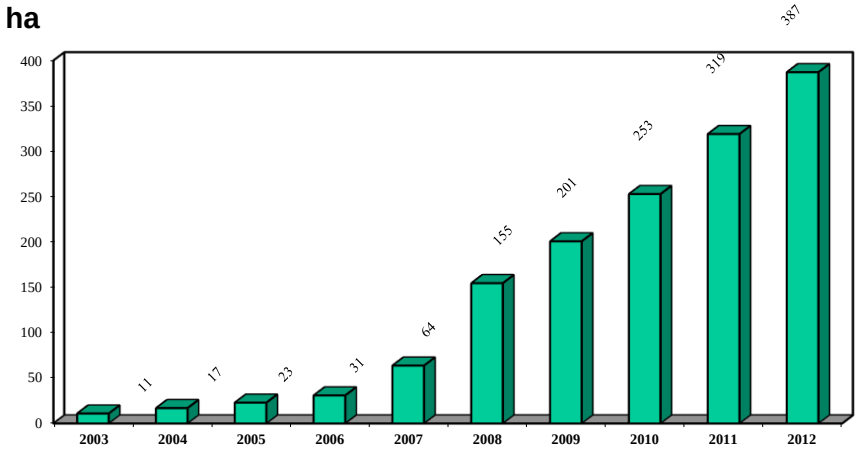

Fig. 1. Dynamics of organic farms in Moldova

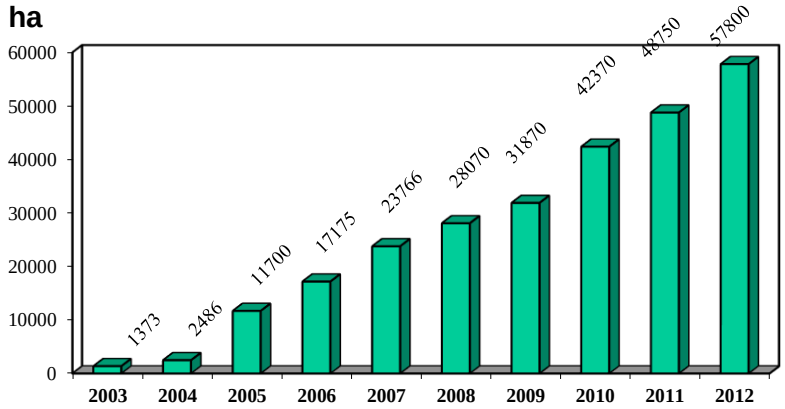

Fig. 2. Dynamics of surface of organic farms in Moldova

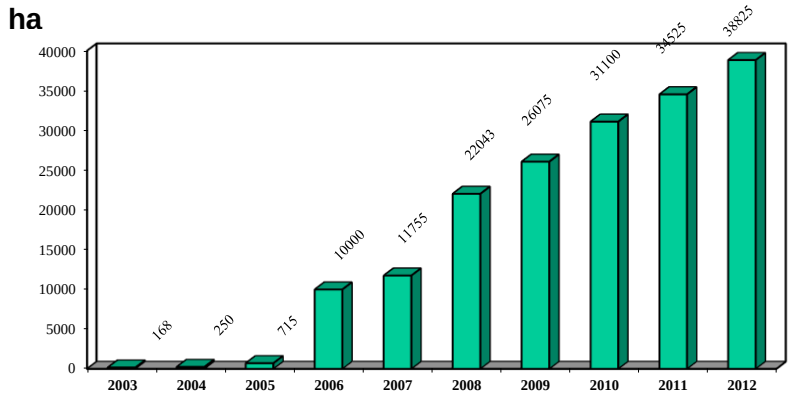

Fig. 3. Dynamics of export of organic products in Moldova

Use of Pesticides in Ecologic Agriculture

Plant protection is one of the major issues in organic farming. Biologic crop protection strategies often rely on a limited number of methods that provide only partial control of pests and that induce lower yields and economic performances. As a result, farmers hesitate to adopt these strategies and doubts are cast on the ability of organic agriculture to feed the world. This chapter questions how agro ecological concepts may contribute to bio control, while taking the different alternative schemes already developed to manage, integrate and design crop protection strategies into account. As demonstrated by a bibliographic analysis, integrated pest management (IPM) remains the leading paradigm in crop protection. It also provides its foundational basis, giving priority to ecological processes and alternative techniques to reduce pesticide use. Beyond IPM, agro ecology is characterized by a holistic approach and the importance given to the design of a "healthy" agro ecosystem. In practice, all these concepts are subject to various interpretations, and organic farming includes a variety of practices, ranging from intensive input-substitution to a comprehensive integrated approach.

Organic farmers should be aware of the law relating to substances used to protect their crops from harmful organisms. In addition to checking that they are allowed to use the product with their organic certification bodies, they must also check that substances or products are permitted for use in this country before using them on their crops.

Even natural substances such as plant oils or ingredients used in the food industry such as pepper need to have an approval before they can be marketed or used as a plant protection product. Any retailers and growers will be the subject of enforcement action should it be discovered that they are marketing or using an unapproved pesticide.

IPM is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

Rolul şi locul preparatelor biologice pentru obţinerea produselor ecologice

Given the experience in the production of biological species and the need to combat harmful organisms that cannot be countered by other means biological, bio developed a special role of local scientists. With their competition they have been implemented and approved a lot of biological means, which is a powerful tool to combat harmful organisms and improving environmental conditions [20; 22]. Among these are the following:

Trichodermin BL is constituted under the fungus *Trichoderma lignorum* and used to combat white rot, gray and root vegetable crops, ornamental, vegetable and tobacco seedlings and vegetable crops, reducing crop attack by pathogens 2-3 times stimulating growth, plant growth by 25-30%.

Trichodermin F7 – based preparation is the fungus *Trichoderma harzianum* granular and liquid. It is used to combat agricultural crops root rots, root rots reducing 1.5-2 times.

Nematofagin-BL is constituted under *Arthrobotrys oligospora* fungus and used for combat nematodes in protect technical and vegetable crops.

Verticil-in – the base of preparation is the fungus *Verticillium lecanii* in the form of a wettable powder. It is recommended for the control greenhouse whitefly to the efficacy of 95%.

Rizoplan is constituted under the bacterium *Pseudomonas fluorescens* AP-33 and is used to combat the root rots of crops.

Pentafag is designed to combat bacterial diseases at crops. The preparation is based on 5 strains of bacteriophages effective in controlling plant diseases caused by bacteria of the genus Pseudomonas.

A lot of viral preparations were developed for pest that cannot be combatted by other biological means.

Virin-ABB-3 - to combat *Hyphantria cunea* in orchards, forests and parks. The preparation is based on nuclear polyhedrosis viruses and cumulative and synergistic action granulosis, showing of the epidemic and post-action effects.

Virin-MB – to combat Cabbage worm and is based on *Mamestra brassicae* nuclear polyhedrosis virus.

Virin-OS – to combat insects of genus *Agrotis* and is based on granulosis viruses and nuclear polyhedrosis synergistic action.

Virin-HS-2 – to combat rootworm by cotton and insects of genus *Heliothis* and is based on nuclear polyhedrosis virus.

Virin-CP is intended to combat codling moth and is based on *Carpocapsa pomonella* granulosis virus.

Conclusions

Application traditional technologies demonstrate indispensable contradiction between the plant protection requirements condition and the need to preserve environment. The systemic approach of relations between crop and pests opens new possibilities in researching biocenotic relationships within ecosystems and halting spending growth trends directed to plant protection.

Integrated plant protection systems, as an element applied conventional and organic farming, is not only a mechanical alternation of chemical methods of pest combating, but a complex of actions aimed at using natural mechanisms regulating the density of populations of organisms harmful and only in critical conditions, implementation of minimum quantities of pesticides.

Ensure effective non-chemical plant protection systems is becoming reality in the deployment of integrated plant protection with predominant application of biological methods of protection.

Biological plant protection - as an efficient method of avoiding the conflict between environmental protection and quality of the plant is based on continuous use of information related to monitoring populations of harmful and useful organisms, and the use of compensation measures and combat application entomophages, bio preparations and biological active substances.

Republic of Moldova has prerequisites and conditions for the extension and deepening of activities sufficient to obtain organic products. Promoting organic agriculture requires improving the legal framework, developing national strategy on organic food production, monitoring compliance of normative acts, strengthening national body for evaluation, inspection and accreditation of operators, supporting farmers to shift conversion period.

Strengthening technology strategy and research functionality to meet needs for technological processes aimed at providing means for obtaining and processing of organic products is the key position in the intensification and extension of educational activities in the taking and processing of organic products.

Organic farming can be a viable alternative production method for farmers, but there are many challenges. One key to success is being open to alternative organic approaches to solving production problems. Determine the cause of the problem, and assess strategies to avoid or reduce the long term problem rather than a short term fix for it.

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SCIENTIFIC BASIS FOR ECOLOGICAL RESTRUCTURING OF AGRICULTURE ON THE STEPPES

Boris BOINCEAN

Moldova, like most countries throughout the world including the republics of the former Soviet Union, followed the industrial model of agricultural intensification with a dependence on mineral fertilizers, pesticides for weed, pest and disease control, dominance of row crops and neglect of animal husbandry. It has paid a high economic, environmental and social price. Seeking a practical alternative farming system, this article draws on data from a long-term poly-factorial field experiment with different crop rotations, systems of soil tillage and fertilization. The effect of crop rotation was determined for different crops under different systems of tillage and fertilization. Crop rotation with perennial legumes and grasses, integrated with animal husbandry, provides self-sufficiency in nutrients and facilitates no-till farming.

Unsustainable farming systems

The industrial approach to agricultural intensification, depending on mechanized power, ever-increasing application of mineral fertilizers and agrochemicals, irrigation, and new crop varieties including GMOs, is unsustainable. Increased yields have been pursued without considering the maintenance of soil fertility, biodiversity, or the health of the whole food chain (Foresight 2011). Across the steppes from Moldova, through Ukraine, Russia and into Central Asia, lack of an holistic approach to the action and interaction between the factors of intensification has been an obstacle to sustainability (Boincean 1999); recent satellite data presented in this issue (Bai and others 2015) indicate a system in trouble.

In Moldova, privatization of agriculture following the collapse of the USSR brought sweeping changes in the structure of the sown area and use of manure and fertilizers (Table 1). The proportion of row crops increased; the area under cereals also increased but opportunities for farmers to drill winter cereals after early-harvested predecessors, crucial under the severe climate of the steppes, have been restricted. Early sowing of winter cereals enables the crop to develop a robust rooting system before the winter sets in and, thereby, ride out drought in the next growing season. Lack of early-harvested predecessors for winter cereals and preponderance of row crops doesn't respect of scientifically based crop rotations. There has been a sharp increase in the area under cash crops like sunflower and maize-for-grain whereas the area under forage crops has fallen dramatically (perennial legumes decreased from 12% of the sown area down to 0.3%) and stockbreeding has almost disappeared. The application of farmyard manure and mineral fertilizers has greatly decreased which means reduced soil fertility and increased vulnerability to soil erosion and drought.

Table1

Change in the sown area in the Republic of Moldova, 1990-2012 (Annual Statistical data)

Indices	**1990**		**2012**	
	thousands, ha	%	thousands, ha	%
Total arable	**1674.5**	**100**	**1460.0**	**100**
Compact-drilled crops	687.9	41	488.8	34
Cereals	407.1	24	453.9	31
Perennial legumes	192.1	12	5.0	0.3
Row crops	986.6	60	971.5	67
Corn for grain	258.0	15	415.9	29
Sunflower	134.1	8	252.4	17
Forage crops	538.2	32	75.3	5
Use of fertilizer				
	Total, thousand tonne	per ha	Total, thousand tonne	per ha
Farmyard manure	9 700	5.6t	15	0.02t
Mineral fertilizers	217	136kg	20	24kg

A basis for an alternative system

Seeking a practical alternative, a long-term polyfactorial experiment was established in 1995 at the Selectia Institute for Field Crops on the Balti steppe in the north of Moldova. The soil is Typical chernozem: a heavy clay with 4.5-5.0% humus (Tiurin), pH_{water} 7.3, pH_{CaCl2} 6.2, and total NPK of 0.20-0.25, 0.09-0.11 and 1.22-1.28%, respectively. The mean annual precipitation (1996-2009) is 544mm. The experiment tests the comparative advantages of a whole landscape approach respecting crop rotation, integration of animal and crop husbandry, minimum soil disturbance, and a higher diversity of genetic resources; and examines the action and interaction between three main components of farming systems - crop rotation with and without perennial legumes and grasses, two systems of tillage and three of fertilization. Each plot is 264 m^2 with three replicates, a total experimental area of 8.7ha. No chemicals are used for control of pests, diseases and weeds. The sequence of crops in the two rotations is:

I. 1. Lucerne + ryegrass, third year after first cut
2. Winter wheat
3. Sugar beet
4. Maize for grain
5. Winter barley
6. Maize for green mass under-sown wit lucerne and ryegrass
7. Lucerne + ryegrass for green mass

II. 1. Maize silage
2. Winter wheat
3. Sugar beet
4. Maize for grain
5. Peas
6. Winter wheat
7. Sunflower

The systems of tillage are: 1) alternation of inversion of the topsoil with the mouldboard plough and ploughless tillage; 2) solely ploughless tillage. The systems of fertilization are: 1) Control (without fertilizer); 2) Composted farmyard manure; 3) Farmyard manure + mineral fertilizers. The same amount of manure is used in both crop rotations (10t/ha) but the amount of mineral fertilizers is different ($N_{12.8}P_{21.8}K_{24.2}$ kg/ha in the first crop rotation, $N_{38.6}P_{24.2}K_{24.2}$ kg/ha in the second). Simultaneously, trials are conducted with continuous wheat, barley, sugar beet, maize-for-grain and sunflower under the two systems of soil tillage and three systems of fertilization, but without replication.

Experimental results and discussion

We have determined the effect of crop rotation for different crops in the rotations with and without the mixture of perennial legumes and grasses, on unfertilized plots and with farmyard manure and with manure supplemented by mineral fertilizers, under both systems of soil tillage. The effect of crop rotation may be taken as the difference in yields between crops in rotation and monocropping. Tables 2-5 present means for three crops over two full rotations.

On the unfertilized control, the benefit of crop rotation with perennial legumes and grasses (Table 2) is higher for winter wheat and sugar beet (104 and 101%) compared with maize-for-grain (37%). Use of farmyard manure in the same rotation under the same system of tillage diminishes the effect of crop rotation but the benefits remain highest for winter wheat and sugar beet (77%) and the lowest for maize (27%). Supplementary addition of mineral fertilizers hardly changes crop yields. The effect of crop rotation is significantly lower in the rotation without the legume-grass mixture (Table 3) but the ranking is the same: highest for winter wheat and sugar beet (without fertilizer 47 and 65%, respectively) and the lowest for maize-for-grain (27%). Application of farmyard manure decreases the effect of crop rotation for all crops but to a lesser degree than in the rotation with perennial legumes and grasses (40, 62 and 23% respectively). Supplementary addition of NPK increases the effect of crop rotation for winter wheat and sugar beet up to 52 and 78%, respectively, but it remains the same for maize (19%) which hardly responds to crop rotation. It is evident that the benefit of

fertilizer, especially, the combination of manure and mineral fertilizer, is greater in the crop rotation that does not include perennial legumes and grasses.

Table 2

Effect of crop rotation including perennial legumes and grasses with different systems of fertilization under a combination of ploughing and ploughless tillage, average for two full rotations (1996-2009)

Crops	System of fertilization							
	Control (without fertilizer)		Farmyard manure		Farmyard manure + NPK			
					± t/ha	%	relative to farmyard manure	
	± t/ha	%	± t/ha	%			± t/ha	%
Winter wheat	+2.15	104	+1.84	77	+1.84	74	-	-
Sugar beet	+17.7	101	+17.0	77	+17.8	79	+0.80	3.6
Maize for grain	+1.38	37	+1.10	27	+1.07	28	-	-

Table 3

Effect of crop rotation without perennial legumes and grasses with different systems of fertilization under a combination of ploughing and ploughless tillage, average for two full rotations (1996-2009)

Crops	System of fertilization							
	Control (without fertilizer)		Farmyard manure		Farmyard manure + NPK			
					± t/ha	%	relative to farmyard manure	
	± t/ha	%	± t/ha	%			± t/ha	%
Winter wheat	+0.97	47	+0.94	40	+1.30	52	+0.36	15
Sugar beet	+11.4	65	+13.6	62	+17.6	78	+4.00	18
Maize for grain	+1.03	27	+0.93	23	+0.83	19	+0.10	2

The system of tillage hardly changes the results (Tables 4 and 5) although the benefit of rotation is somewhat increased for winter wheat and sugar beet under ploughless tillage.

Table 4

Effect of crop rotation for different crops in rotation with a mixture of perennial legumes and grasses with different systems of fertilization under ploughless tillage, average for 1996-2009

Crops	System of fertilization							
	Control (without fertilizer)		Farmyard manure		Farmyard manure + NPK			
					± t/ha	%	relative to farmyard manure	
	± t/ha	%	± t/ha	%			± t/ha	%
Winter wheat	+2.36	127	+2.06	97	+2.11	93	+0.05	2
Sugar beet	+17.0	113	+11.2	44	+17.7	86	+6.5	25
Maize for grain	+1.25	33	+1.05	26	+1.00	24	-	-

Table 5

Effect of crop rotation for different crops in rotation without mixture of perennial legumes and grasses with different systems of fertilization under ploughless tillage, average for 1996-2009

Crops	System of fertilization							
	Control (without fertilizer)		Farmyard manure		Farmyard manure + NPK			
					± t/ha	%	relative to farmyard manure	
	± t/ha	***%***	***± t/ha***	***%***			***± t/ha***	***%***
Winter wheat	+1.15	62	+1.10	52	+1.61	71	+0.51	24
Sugar beet	+12.3	82	+7.6	30	+15.8	77	+8.2	32
Maize for grain	+0.99	26	+0.79	20	+0.77	18	-	-

Reviewing all the data, we may conclude that it is possible to save the expense of applying fertilizers in a crop rotation with a mixture of perennial legumes and grasses. And where an adequate dressing of farmyard manure is applied, the cost of supplementary mineral fertilizers is hardly justified in either crop rotation (Table 6).

Under the crop rotation with the mixture of perennial legume and grasses on *unfertilized plots,* the yield increase of winter wheat is 38-40%; the yield increase of winter wheat under the influence of farmyard manure is 27-30%; supplementary application of NPK increased winter wheat yields by 13-14%. But the effect of fertilization depends on the rotation. The least increase in wheat yield from application of manure and fertilizer was in the rotation that included the perennial legume-grass mixture (2-5%). The highest increase was in the rotation without the perennial legume-grass mixture (14-29%) and, in this rotation, the effect of manure plus mineral fertilizer is greater than for manure alone (24 and 14%, respectively). The efficiency of both systems of fertilization is greater under ploughless tillage compared with the combination of ploughing and ploughless tillage (29 and 21%, respectively).

Table 6

Yields of crops in crop rotations with and without a mixture of perennial legumes and grasses under different systems of fertilization , average for two full rotations (1996-2009)

Soil tillage	**Control (without fertilizer)**			**Farmyard manure**			**Farmyard manure + NPK**			**Farmyard manure + NPK**			
										± relative to farmyard manure		**± relative to control**	
	1	**2**	**± / %**	**1**	**2**	**± / %**	**1**	**2**	**± / %**	**1**	**2**	**1**	**2**
a) Winter wheat													
Mouldboard plough	3.04	4.22	+1.18 /39	3.32	4.22	+0.9 /27	3.78	4.32	+0.54 /14	+0.46 /14	+0.10 /2	+0.74 /24	+0.10 /2
Ploughless	3.01	4.22	+1.21 /40	3.22	4.18	+0.96 /30	3.89	4.39	+0.50 /13	+0.67 /21	+0.21 /5	+0.88 /29	+0.17 /4
Difference	-0.03 /1	0		-0.10 /3	-0.04 /1		+0.11 /3	+0.07 /2					
b) Sugar beet													
Mouldboard plough	28.9	35.2	+6.3 /22	35.6	39.0	+3.4 /10	40.2	40.4	+0.2 /0.5	+4.6 /13	+1.4 /4	+11.3 /39	+5.2 /15
Ploughless	27.4	32.1	+4.7 /17	33.3	36.9	+3.6 /11	36.4	38.3	+1.9 /9	+3.1 /9	+1.4 /4	+9.0 /33	+6.2 /19
Difference	-1.5 /5	-3.1 /9		-2.3 /7	-2.1 /5		-3.8 /9	-2.1 /9					
c) Maize for grain													
Mouldboard plough	4.81	5.16	+0.35 /7	5.07	5.24	+0.17 /3	5.13	5.37	+0.24 /5	+0.04 /1	+0.13 /3	+0.32 /7	+0.21 /4
Ploughless	4.75	5.01	+0.26 /6	4.85	5.11	+0.26 /5	4.96	5.19	+0.23 /5	+0.11 /2	+0.08 /2	+0.21 /4	+0.18 /4
Difference	-0.06 /1	-0.15 /3		-0.22 /4	-0.13 /3		-0.17 /3	-0.18 /3					

1. Rotation without perennial legumes and grasses.
2. Rotation with perennial legumes and grasses.

The impact on yields of the predecessors of winter wheat is significantly more than the system of fertilization. The predecessors of winter wheat in crop rotations even influence the yields of the following sugar beet and maize crops; the yield increase of sugar beet on unfertilized plots after winter wheat sown into the perennial legume-grass mixture is 17-22% higher than the yield of sugar beet sown after winter wheat following maize silage. Fertilization with manure and manure-plus-mineral fertilizer attenuates the influence of predecessors.

In the rotation with the perennial legume-grass mixture, supplementary mineral fertilizers hardly change the yield of sugar beet – just as with winter wheat. This indicates a real cost saving to be made

by cutting the rates of mineral fertilizers when farmyard manure is applied – the problem is the lack of farmyard manure. Both animal husbandry and crop rotation were neglected during the industrialisation of agriculture and, in Moldova, the situation worsened after privatization - yet integration of animals in crop rotations that include perennial legumes and grasses eliminates, the need for mineral fertilizers. The yield data for different crops in both rotations have been used to calculate the equivalent forage units and digestible protein (Table 7). The superiority of the crop rotation with the mixture of perennial legumes and grasses in these terms is clear and this translates to milk and pig-meat production (Table8). The calculation assumes that production of 1 litre of milk needs 1.2 forage units and 104g digestible protein per forage unit; and production of 1kg of pork needs 6 forage units and 110g digestible protein per forage unit. We have taken an average annual production per milk cow as 4000l and the average marketable weight per pig on feed lots as 100kg.

Knowing the numbers of cows and pigs to be fed, it is possible to calculate the amount of manure/ha and its NPK content (Table 9). Table 10 compares the amount of NPK taken up by crops and returned to the soil through the solid and liquid fractions of farmyard manure.

Table 7

Production of forage units and digestible protein in the poly-factorial experiment, average for two full crop rotations (1996-2009)

Indices	**Crop rotation without mixture of perennial legumes and grasses**		**Crop rotation with mixture of perennial legumes and grasses**	
	Farmyard manure	Manure + NPK	Farmyard manure	Manure + NPK
Forage units, tonnes (without straw)	19.4	21.1	28.2	29.3
Digestible protein, kg (without straw)	1882.9	2054.0	3600.8	3713.1
Digestible protein, g/ forage unit	96.9	97.4	127.7	128.7

Table 8

Milk and pork production on 1 ha of crop rotation, average for two full rotations (1996-2009)

Animal products	**Crop rotation without mixture of perennial leguminous crops and grasses**				**Crop rotation with mixture of perennial leguminous crops and grasses**			
	Farmyard manure		Farmyard manure + NPK		Farmyard manure		Farmyard manure + NPK	
	on forage units	on digestible protein	on forage units	on digestible protein	on forage units	on digestible protein	on forage units	on digestible protein
Milk, litres	16 192	15 090	17 575	16 450	23 500	28 858	24 417	30 204
Pork, kg	3 238	2 853	3 515	3 111	4 700	5 457	4 883	5 713

Table 9

Total amount of NPK in the solid and liquid fractions of the farmyard manure from cows and pigs produced from the experimental crop rotations, kg and kg/ha of crop rotation

Farmyard manure	**Crop rotation without mixture of perennial crops**						**Crop rotation with mixture of perennial crops**					
	Farmyard manure			Farmyard manure + NPK			Farmyard manure			Farmyard manure + NPK		
	N	P	K	N	P	K	N	P	K	N	P	K
Cows												
Solid fraction	228	105	228	246	113	246	432	199	432	456	210	456

Liquid fraction	163	83	205	176	90	221	309	158	388	326	166	409
Total	**391**	**188**	**433**	**422**	**203**	**467**	**741**	**357**	**820**	**782**	**376**	**865**
Total per 1 ha of c.r.	56	27	62	60	29	67	106	51	117	112	54	124
Pigs												
Solid fraction	282	359	286	308	392	288	549	688	492	565	720	515
Liquid fraction	420	363	232	458	397	253	804	696	444	841	728	464
Total	**702**	**722**	**518**	**766**	**789**	**541**	**1 353**	**1 384**	**936**	**1 406**	**1 448**	**979**
Total/ ha of rotation	100	103	74	109	113	77	193	198	134	201	207	140

Table 10

NPK taken up by crops and returned to the soil in farmyard manure in the experimental crop rotations, average for two full rotations (1996-2009), kg NPK/ ha of crop rotation

Crop rotation with mixture of perennial leguminous crops and grasses						**Crop rotation without mixture of perennial leguminous crops and grasses**					
Farmyard manure						**Farmyard manure**					
Nutrients taken up			**Returned nutrients**			**Nutrients taken up**			**Returned nutrients**		
N	P	K	N	P	K	N	P	K	N	P	K
Cows											
145	45	135	106	51	117	111	40	119	56	27	62
Pigs											
145	45	135	193	198	133	111	40	119	100	103	70
Farmyard manure + NPK						**Farmyard manure + NPK**					
N	P	K	N	P	K	N	P	K	N	P	K
Cows											
151	46	139	112	54	124	124	45	132	60	29	67
Pigs											
`	46	139	201	207	140	124	45	132	109	113	77

Integration of milk cows with the crop rotation including perennial legumes and grasses doesn't compensate for crop's uptake of nitrogen with the nitrogen applied with farmyard manure; there is a deficit of 39kg/ha but this deficit is compensated by the lucerne through symbiotic nitrogen fixation. The balance of phosphorus is positive; a small deficit of potassium isn't a problem on chernozem soils, which are very rich in potassium. Integration of pigs in the rotation including the perennial legume-grass gives positive balance of nitrogen and phosphorus. There is no need for supplementary application of NPK to this crop rotation. In the case of the crop rotation without the perennial legume-grass mixture, integration of cows compensates for only half of the NPK taken by the crops; integration of pigs compensates for only for the phosphorus deficit and additional sources of nitrogen, including nitrogen from mineral fertilizers, has to be found. We should also note that the quality and the capacity of cow and pig manure to restore soil fertility are different – cow manure is preferable but a combination of different animals creates the best conditions for complete restoration of soil fertility on the farm.

Conclusions

Structural changes in the agriculture of Moldova since 1990 have contributed to soil degradation, water pollution, reduction of crop productivity and increasing the vulnerability to climate change. Putting things right requires ecological rather than technological restructuring; respect for crop

rotation will increase the resilience of the farming system through crop diversity and lesser dependence on external, industrial inputs. What is true of Moldova probably applies in large measure to arable land across the steppes as far as Central Asia:

1. The benefits of crop rotation are greatest on unfertilized plots, especially with a rotation including perennial legumes and grasses, and the rates of mineral fertilizers can be reduced in crop rotation with the mixture of perennial legumes and grasses. This is significant in view of the unaffordability of mineral fertilizer and lack of farmyard manure.

2. Supplementary use of mineral fertilizers doesn't influence the yields and effect of crop rotation for different crops relative to farmyard manure.

3. The effectiveness of fertilizer is increasing by ploughless tillage, especially in crop rotation without a perennial legume-grass mixture.

4. The idea of integrating crops with livestock comes from the original Norfolk four-course rotation. This was more than crop rotation – it produced forage for livestock so as to restore soil fertility. This approach was abandoned during the era of agricultural industrialisation but integration of animals in crop rotations with a mixture of perennial legumes and grasses renders unnecessary industrial inputs like mineral fertilizers and agrochemicals for pests, disease and weed control.

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REVIEW
On the manual "Treaty of Environmental Law"
Author: Valentin AŞEVSCHI, Doctor of Biology, Associate Professor

In the manual "Treaty of Environmental Law" are exposed the theoretical and practical bases, methodical and methodological aspects of Environmental Law. The exposed material deals and systematizes obtained data in the field of scientific researches on the issues of the environmental law.

Mr. Valentin Aşevschi proposed himself the goal to substantiate the theoretical bases of that kind of strategy, and to examine the practical aspects of environmental law reform and its development, formulating recommendations related to its improvement, having as a case study the Republic Moldova. In this regard, the work is a theoretical support and a practical tool, which is useful for the specialists in that domain.

An important objective of this Treaty resides primarily in solving the main problems and shortcomings that mark the normative-legal context, the fair and appropriate resolution of which would be able to increase the quality and effectiveness of the environmental legislation as a whole.

In this regard, in the local doctrine often only some aspects are studied in the field of environmental law, with the elucidation of legal deficiencies at a legal institution level or ecological sub-branch. Through such a differentiated approach, however can not be identified fair and efficient solutions for the entire system of environmental legislation. Therefore, this work is conducive for Moldova.

The author performs a comprehensive study of the essence, structure and functioning of ecological legislation in the Republic of Moldova as a system, elucidates the most significant problems that marks its development at present.

We also support the ideas of the Associated Professor V. Aşevschi on environmental performance evaluation and ways to improve the environmental policy. Although Moldova currently holds all the policy documents covering virtually all areas of environment, it requires a continuous renovation of them and as a result, developing and adopting a new national strategy for environmental protection. These documents should take into consideration new circumstances in which the Republic of Moldova would offer a new conceptual basis in the field, the general objective of which would be promoting a sustainable development of principles through increasing the green economy and environmental protection.

We agree and support the author that among the main objectives of the further development of the legal framework can be the harmonization of the national legislation with the European Union, and creating an Environmental Code of the Republic of Moldova.

Another primary task in this area, already accepted by most experts, is a new law on environmental protection. This is conditioned not only by the fact that during the 20 years of its inception, the socioeconomic conditions have changed radically, but also by the current requirements of approximation of the national legislation to the EU Directives and the need to implement a single policy on environmental protection and use of natural resources that integrate the environmental requirements in sectors of the national economy.

Based on this, we appreciate the true value that drawing up such a work is a part of the books that require integration of conceptual elements and practical subjects in the field considered. The content of ideas and approaches can be used successfully reflected by all those interested in scientific research on environmental issues.

This work encompasses different modules and systematize teaching materials on environmental law.

This study presents the theoretical foundations and practical substantiation of environmental law in all its methodological aspects, including the object of study, theoretical and applied fields, the basic principles, methodical arsenal and finally, the evolution of paradigms. Such a presentation offers works that fully describes the methodology of the scientific disciplines and points of view expressed, opinions are different and even contradictory. This has conditioned the opportunity and timeliness of the paper concerned.

It represents the assemblies of environmental, economic and social components and combine in a single system the population with all the products of its activity and the environment within a geographic or administrative subdivision - the globe, associations of states, the state, administrative regions or municipalities and industrial enterprises, agricultural or otherwise.

In accordance with the concept of the law systems school, these social-ecological and legal systems must be regarded as organic elements (subsystems) of the general law of the socio-economic complex, which is composed, in turn, from a number of elements, particular sectors that is the dialectical relationship of interaction.

Environmental law has a social feature, namely is linked directly with the impact on people. Changing the state of the environment in the necessary direction for the society is not ensured in the process of environmental management directly, but indirectly through the people's will and conscience, namely of the social system. The Environmental law is not a simple activity and unconsciousness, but a non-specific form of it, linked to the formation and adoption of decisions, their implementation in practice, to the rules of the system in accordance with the goals set in advance, with the generalization of the results of data processing and the use of them.

Since ancient times, man has tried to hold the nature with its harsh laws to be followed for survival. In the last two centuries, there was however felt through behaviour and concepts, man's attempt to dominate nature, to use for itself all the natural resources, emphasizing progressive conflict between the natural cycling processes of the ecosphere and linear technologies created and supported by human civilization, thus reaching the ecological crisis".

The work “Treaty of environmental law” study methods, principles, tools, technologies to reduce the negative impact on the environment by economic agents and population to minimize the risk for environmental damage caused by them.

This manual is a response of the scientific community to the environmental crisis. Today humanity faces two major antagonistic problems- the economic growth and environmental pollution. In this situation are necessary effective actions to eliminate the consequences of the negative impact of human activities on the ecological systems.

Therefore, solving a problem that define value to human society, such as environmental protection can not be achieved without the knowledge and application of specific rules. Considering that natural phenomena arise independently of human will and that any human intervention in the environment inevitably makes modifications, we ascertain that the procedures used in solving these problems must be the most categorical, so in the end to exclude the intervention or completely eliminate its consequences.

The work involves familiarizing students with the science of environmental law, oriented to the efficient management of the environment at all levels of management based on environmental programs and projects developed under the principles of economic efficiency. In this paper are exposed the theoretical bases and the practical ones, methodical and methodological of the Environmental Law Treaty.

The modern technical-scientific revolution that takes place at a pace of increasement and acceleration ,is increasing in all countries, both in the industrialized and in the developing, put before

mankind more troubles determined by practical conditions of the last decade of the twentieth century and the beginning of the third millennium. Almost without realizing it, people started moving vast ecological experiments involving the entire Earth without having currently the means to systematically track results. Everywhere in the world, ever more insistently, are imposed actions to support environmental protection, which is one of the priority concerns of contemporary.

The author correctly notes that Moldova has today a national strategy for sustainable development based on the principles of environmental law. The manual of Environmental Law Treaty suggests a holistic approach to all real development problems facing Moldova, highlighting all aspects of applying political and economic instruments and the way in which good practice could be generalized for the conservation of resources necessary for the development.

There are well described the compartments: The legal relationship of the environmental law, the rights and obligations of the citizens and the environmental NGOs, ownership and other rights to the objectives of nature, that are about legislation and decisions of the Government of RM, and international conventions signed and rectified by the country's parliament that indicates citizens' rights to a healthy life, the right to truthful information and justice, the right to make decisions while indicating also the bonds of every citizen to contribute directly in environmental protection in order to transmit the whole of this heritage to our descendants.

Based on the rich experience the author analyses environmental law in the sustainable development making a broad description of the ecology of the elements of ecology, the site of the ecology among other sciences, man's place in nature and society, the general laws of ecology, the concept of environment, the environmental pollution, environment - global problem of humanity. The concept of environment and environmental protection have become the priority directions of the policy of the Moldovan state.

The unit of diversity that manifests the surrounding reality is a truth that finds itself an increasingly broad support by the wider development of science. The scientific concerns on narrow fields are just a necessary step in the integration of information into concepts, legal, paradigms able to explain the evolution of a system, and thereby assuring scientific durability.

Truly, natural sciences provide economic approaches to environmental economic knowledge, understanding of the causal relationship between the structure and dynamics of natural systems, natural productivity assessment and determining the spatio-temporal dimension of this productivities use of resources.

In relation to the interdisciplinary nature, the integrative nature of international protection of the environment shows that this discipline requires the use of knowledge in various fields, creates concepts, formulate its laws and identify their tools, necessary for the scientific approaches.

The concepts of conservation, development and protection of natural environment components acquires a specific content within this discipline. Current issues of international environmental problem and international cooperation in environmental protection, trans boundary pollution and allocation of costs and environmental benefits, the eco conversion of the external debt, green economy of natural resources, contributions to ecological law to diversify scientific language, with the aim of defining new problems facing humanity and which are the subject of study – acute problem of mankind.

Based on these considerations and taking into consideration the purpose, the work was conceived as a theoretical textbook, a complex guide, which raise issues, showing their current level of development and guidance outlines the various ways to solve them. For this reason the main emphasis in the ministry aims the methodological and investigational approaches.

The manual is divided into 8 modules. The first two modules include general concepts on ecology, environment and sustainable development.

In the modules III and IV Environmental Law as an autonomous branch of law and the legal relationship of environmental law include: organizing and legislating steps of environmental law; The state administration in environmental protection and natural resource use; Definition and object of environmental law; The principles of environmental law; Ways of implementing the principles of environmental protection; The duties and functions of environmental law; General terms of legal environmental relationship; Subjects of the legal environmental relationship; The legal environmental relationships contents; The object of the relationship of environmental law.

In the module V are described the environmental rights and obligations of citizens and environmental NGOs. Ownership and other rights over natural objects and natural resources sub-compartments: Highlights of the content; Access to justice in environmental matters; Ownership and other rights over natural objects and natural resources.

Special interest shows the module VI – state administration in the environmental protections and ecological resource management. The ecological expertise and biological control includes: Highlights of the content; Environmental impact assessment and environmental expertise; The control of compliance the environmental law; The mechanism of organization and conducting ecological inspection oof the environment;

Module VII – ecological and legal liability in environmental law: legal liability in environmental law relationships.

In Part 2 of the paper – conservation, development and protection of natural environment components are described the legal regimes.

The work is theoretical and practical, indicating working methods so that it can be used as a basis for those who want to start a concrete and objective research.

This summary study will be useful, primarily for undergraduate, postgraduate, doctoral students, researchers and specialists in the field of environment, but may represent an interest particularly for organizations and institutions concerned with the implementation of strategies and environmental policies, contributing significantly to growth and improvement of the environmental performance of Moldova adjusted to EU standards.

The manual is aimed at profile students, environmental, ecotoxicological, teachers, masters, specialists with similar environmental and ambient engineering, but at the same time, all those who want to enter the issue of ecology: researchers and specialists in this field as well and the public. The material exposed deals and systematize data obtained in the field of scientific research on environmental law issues.

The manual is a work of methodical-didactics and valuable scientific synthesis for students, teachers, master specialized in environmental protection for all who wish to enter the issue of ecology.

The manual is made in accordance with the curriculum of this course and special disciplines, institutions of higher learning. They include some achievements in the field of laboratory research, some objections and practical decisions accrued at the University of European Political and Economic Studies "Constantin Stere", Ecology and Environmental Protection Department. In that field the present work is one of the pioneering, aimed at achieving disciplinary goals and addresses to teachers and students from the education.

This summary study will be useful also for the specialists concerned about the professional continuing training, but may represent interest for organizations concerned with the methods of management and audit scheme to help increase and improve the environmental performance in

Moldova. The production of this manual is welcomed because it is necessary for starting growing generation in environmental law issues – acute problem of mankind.

The author of the textbook selected, thought and realized in an impeccable way a valuable didactic work, and the appearance of the manual will be welcome and will complement the universities libraries, and the Republicans ones. The course literature clearly reveals that lofty style, academic, appropriate to the rigors of modern education program.

The paper Treaty of Environmental Law recommended for publication.

For originality of the work and contribution to the enrichment of universal treasure, we address to the author warm greetings, good wishes, prolific activity with luck and inspiration.

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Cuprins

Articol de fond

Studii de sinteză

Cercetări experimentale

Ecologie umană

Ecosisteme naturale şi antropizante

Noutăți editoriale