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Problems of Ecological Morphology of Human beings and Animals.

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ABSTRACT

In this article the five main problems of modern ecological morphology are given. They are: the study of life-forms; biocycles of species; the interrelation of phylogeny and ontogeny; the development periodization of organisms, systems, organs and tissues; the study of laws of organism's individual development.
Keywords: ecology, problems, morphology, laws of human and animal development.

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INTRODUCTION

The influence of ecology on modern science is so large that it is possible to speak about ecological world view. According to A.V. Jablokova (1987) "Ecology turned to a system of disciplines having become a great ecology that solves not only biological but also technological and social problems". The introduction of the ecological approach is happening almost in all branches of human knowledge, production, education and upbringing. Under the influence of ecology scientific fields in biology (biology and morphology), geography, economy and cosmonautics are pullulating. Ecological morphology of human beings and animals is one of these fields and this article is devoted to its problems.

ECOLOGICAL MORPHOLOGY

Ecological morphology has a methodological meaning, a lot of fundamental biological and philosophical questions such as the principle of systematics; the role of external and internal factors in adaptive targeting of evolution; dialectical unity of an organism and environment, spatiotemporal aspects of biosystem dynamics and etc. are reflected in it. The penetration of the morphological and ecological approach to different fields of biology gives the opportunity to solve theoretic and application tasks of national economy from a new angle (Sharova, Sveshnikova, 1988). Ecological morphology is a new scientific discipline formed in XX century at the junction of classical morphology and ecology. It studies the essence, intermutation, the origin of adaptation (adjustment) and life-forms for solving biocenotic, biogeographic and ecological tasks. It has a connection with applied ecology, bionics, biotechnology and environmental engineering, medicine, veterinary science and etc. The idea of ecological morphology has ancient roots. People classified animals and plants (herbs, trees, fishes, birds, animals) according to morphological shape back in ancient times. When biology as a science emerged, it and its subdiscipline, "biological systematics", were developing on base of affined likeness between organisms. Aristotel (IV century BC), C. Linné (XVIII century), A. Gimboldt (1808), Ch. Darwin (XIXth century) and some others used the morphological approach to organism construction. Charles Darwin applied the morphological and ecological approach for the first time for explaining adaptogenesis tendencies – adaptive evolution. The morphological and ecological approach was used by V.O. Kovalevski – for grounding ways of adaptive evolution of various horse groups that inhabit forests to the life in steppe landscapes; Ch. Raunkiaer (1907) – for classifying life-forms of herbs; H. Gams (1918) – for making a unified system of life-forms for herbs and animals. The substantial contribution to the development of ecological morphology was made by our native botanists I.G. Serebriakov (1962), T.I. Serebriakova (1971, 1972), A.P. Khokhriakov (1975) and zoologists– M.S. Giliarov (1949), I.V. Stebaev (1971), Ju.G. Aleeev (1986).

The currently central problems of ecological morphology in XXI century are 1) the study of development and dynamics of organism's life-forms in ontogenesis process; 2) the study of species biocycles; 3) the interrelation of phylogeny and ontogeny; 4) the development periodization of organisms and its systems, organs and tissues; 5) the establishment of laws of organism's individual development. The main applied aspects of ecological morphology are the usage of life-form principles in coenobiology, bionics, biotechnology and environmental engineering aimed at solving tasks of modelling and creating man-made ecosystems and also working out measures for natural biocenosis and agrophytocenosis.

THE STUDY OF DEVELOPMENT AND DYNAMICS OF ORGANISM'S LIFE-FORMS IN ONTOGENESIS PROCESS

The problem "Life-form" is one of the basic terms of ecological morphology (EM). Life-form is an adaptive type of organism and its systems, organs, tissues and cells with formal resemblance. For instance, the formal resemblance of animals and plants of different kinds and types inhabiting one and the same environment and leading identical lifestyle: torpedo shaped aquatic organisms – a squid, a barracuda, an ichthyosaurus, a seal have similar external appearance in the same way as worm-shaped geobionts – nematode worms, earthworms and slugs of clegs (Sharova, Sveshnikova, 1988).

Life-form is a similar morphological and ecological organization of organism groups at any stage of a biocycle with different degree of propinquity that reflects the particularities of their lifestyle in a particular ecosystem. The adopted notion "life-form" has a general biological significance and can be applied to any living organism and used in physiology, developmental biology, phylogeny, evolution theory, population ecology, biocenology and other sciences.

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THE STUDY OF SPECIES BIOCYCLES

Upwards 40-50-ies of XX century botanists pay attention to the study of the life-form problem in dynamics of individual development. The majority of botanists admit ontogenesis changes of life-form (Serebriakova, 1980). However, some scientists take ontogenesis as making life-form of an adult plant and others consider that different stages of ontogenesis according to the habit should be viewed as self-consistent life-forms. According to I.G. Serebriakova (1980) the following alternating life-forms in oak ontogenesis: young plant; bushy tree, narrow-crowned small trees, wide-crowned trees and coppice shoots are distinguished. Plants have a specific habit and different adaptive peculiarities and also different life-form at each stage of ontogenesis. K. Frideriks (1932), the founder of zoological classification of life-forms, recognized the change of life-forms in animal ontogenesis. He supposed that it is possible to sort out separate stages of ontogenesis development as different life-forms. So, according to his opinion a frog larva can be classified among the same life-form as fish and a frog – as another life-form. A. Rehman (1943), M.S. Giliarov (1949), S.A. Zernov (1949), G.A. Mazokhin-Porshniakov (1954) shared this point of view. The last mentioned said that insects with a full cycle of transformation have the stages (an egg, a slug, a propupa and an imago) that refer to different forms. The morphological and ecological approach to the study of animal biocycles was introduced by V.N. Beklemishev who applied it to entomology. Monographs by I.I. Shmalgauzen (1964) became classical works in ecological morphology of animals. The change of life-forms of animals developing with metamorphoses is also practically assured. However, the point that animals with partial development cycle (embryonary, neanic and postnatal periods) and with direct development cycle (embryonary and postnatal periods) have life-forms is open to question. According to our research birds, mammals comprising also human beings) have hidden life-forms (neanic form and metamorphose) [1, 2]. This is proved by our advances in understanding of agricultural physiology – “the higher mammals have embryonary digestion” (Krinitsin, Ilin, Teltsov, 1972) that proceeds after the neanic type.

THE INTERRELATION OF PHYLOGENY AND ONTOGENY

Theory of Evolution by Ch. Darwin proved convincingly that species are changing in the process of historical development and upon that the individual development of animal units is also changing. The study of ontogenesis casts light upon the origin of species. In 1866 E. Haeckel, the Darwin’s successor, phrased the biogenetic law (the Haeckel’s law): “Ontogeny is a short and quick repetition of phylogeny”. The works by lots of embryologists helped to make it plain the historical origin of a number of animals on basis of ontogenesis studies. For instance, E. Haeckel and F. Muller revealed systematic location of barnacles, Kovalevskii – of lancelets and ascidians. The dialectics of interrelation of ontogeny and phylogeny is not reflected in the biogenetic law by E. Haeckel and F. Muller [3] and the role of ontogeny as a source of new phylogenetic transformation is underestimated. The theory of phylembryogenesis by A.N. Severtsov filled this gap. Phylembryogenesis is understood as those new features of an embryon that change phylogeny. A.N. Severtsov came up with the idea of distinguishing three types of phylembryogenesis: archallaxis – at the beginning, deviations – in the middle of embryogeny and anaboly – at the end. According to contemporary conceptions it is not ontogeny that repeats phylogeny but “phylogeny is a historical row of ontogenies”. Ontogeny changes as a unity in the process of evolution. Dialectics of this process is that every period, stage and phase of ontogenesis has its own development history and it changes under the influence of the natural selection. The natural selection contributes to the preservation of characteristics providing the development of organs that are necessary for life of organisms. According to our research [4] critical phases can be observed at the joint of periods, development stages. The following processes are going on in critical phase: 1) the change of metabolic activity, energy metabolism and information exchange (nutrition, breath, thermoregulation and etc.); 2) delayed hypersensitivity of organism and its systems, organs and tissues; 3) degenerative processes prevail over regenerative ones; 4) the change (replacement) of organ functions and form by a new geniture; 5) desynchronization of organ functions and organism’s systems; 6) comprisal of new genes in work; 7) mutagenesis in genes [5]. It is necessary to know the duration of constituent stages and critical phases of organism, organism’s morphofunctional peculiarities at each development stage, chemical constitution of tissues and biological rhythms of daily living activities in order to controll the development of animal and plant ontogenesis. These problems are studied by developmental biology and ecological morphology.

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THE PERIODIZATION OF DEVELOPMENT OF ORGANISMS, SYSTEMS, ORGANS AND TISSUES

The individual development of an organism during lifetime is called ontogenesis (vivogenesis). Ontogenesis as well as evolution covers main life characteristics. On one hand ontogenesis is a continuous process aimed on attaining final cause of creating a mature adult, a carrier of heritable genes. On the other hand it is a discrete process including the whole history of species development (phylogeny) and consists of time lines: periods, stages, phases. Each period, stage and phase isn't repeated but otherwise it negates the previous one. As a whole animal and plant ontogenesis is measured according to final development cause with taking into consideration the origin of each period, stage and phase. The adaptation of organism differs at each development stage as chemical constitution of cells, tissues and systems also differs [1]. The development periodization of live-stock animals and plants was firstly introduced by K. Baer (XVIII в.). A lot of scientists all over the world were engaged in working out the development periodization of animals and human beings – J. Hammond, V.M. Patten, G.A. Shmidt, S.N. Bogoliubskii, K.B. Svechin, I.A. Arshavskii, G.I. Zabaluev and others.

We introduced the contemporary conception of the development periodization of live-stock animals, birds and human beings with taking into consideration systematic parameters of species and subspecies. The ontogenesis periodization of animals and human beings due to area-based and ecological conditions is necessary for practice as it is a biological base for influence on an organism [6]. The acquired information about animal and human development in ontogenesis determines: the level of knowledge about life of an organism; timeframes of preventive activities; strategy and tactics of treatment of human and animal patients with taking into consideration chemical constitutional peculiarities at each stage; scientifically proven well-minded system of social conditions of human lives and the technology of management, feeding and exploitation of live-stock animals and birds [7].

THE ESTABLISHMENT OF LAWS OF ORGANISM'S INDIVIDUAL DEVELOPMENT

Along with the development of population ecology, genetics and developmental biology the population approach to the diagnostic of biological phenomena came to stay. While studying dynamical processes of population a great attention was paid to species morphogenesis, in other words, ontogenesis. It is becoming obvious nowadays that the notion "ontogenesis" in not sufficient for characterizing morphogenetic processes of organisms in a population. All types of ontogenesis (direct, indirect) are linked in life cycles of animals and human beings. Many morphologists consider the notion "a life cycle" as a synonym of the notion "ontogenesis". In this case the confusion of notions – "species morphogenesis" (self-preservation, reproduction, capacity to evolution) and "animal unit morphogenesis" (feeding, breathing, excretion, pullulation, self-protection, capacity to mutation) that are proceeding at different biological levels happens. A life cycle is a cycling species morphogenesis including one or more connected types of ontogenesis that fulfil all the main functions. The problem of species life cycles has a great importance for development of ecological morphology, physiology, genetics and ecology and for solving tasks of applied biology connected with practice.

The theory of ways of ontogenesis adaptive evolution was worked out by A.N. Severtsov. A biological process is the increase of organisms' adaptiveness to the environment that leads to amplification and great variety of forms and to their vaster expansion in nature. According to A.N. Severtsov the main ways of a biological process are aromorphosis, idioadaptation and retrogressive evolution. The problem of ways of a biological process was later developed more deeply in the works by I.I. Shmalgauzen (1969). He marked out the following lines of a biological process: aromorphosis, allomorphosis, telomorphosis, hypermorphosis, catagenesis and hypomorphosis.

CONCLUSION

We [2, 8, 9] established 8 laws of individual development revealing the essence of ontogenesis. However, ecological morphology of mammal and human ontogenesis and the capacity of an organism to adaptation at different development stages are studied poorly [1, 8, 10]. They are waiting to be investigated as XXI century is "a century of a biological and medical revolution".

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