

Ukrainian Journal of Ecology

About the Journal

Ukrainian Journal of Ecology is an Open Access, Quarterly, peer-Reviewed Journal. Formerly known as "Biologičnij vїsnyk Melitopol's'kogo deržavnogo pedagogičnogo universitetu imeni Bogdana Hmel'nic'kogo", the print version of the journal has served the scientific community from 2011 to 2016. Since 2017 the digital form of the same is available as 'Ukrainian Journal of Ecology'.

Ukrainian Journal of Ecology publishes original scientific research work dealing with all aspects of ecology, with special regards to ornithology, entomology, ecology of population, community, forest research, forest ecology and ecosystem. Without considering taxon, environmental and geographical limitations, the journal accepts empirical studies, case reports and qualitative research from a wide range of topics within these fields.

Authors may submit their article

online: <https://www.scholarscentral.org/submissions/ukrainian-ecology.html> or

send as an e-mail attachment to the Editorial Office at ecology@jopenaccess.org

Journal is indexed in:

- **Web of Science (Emerging Sources Citation Index)**
- **CAB Abstracts**
- **ProQuest**
- **DOAJ**
- **Google Scholar**
- **EBSCOhost**
- **JournalTOCs**
- **Scilit**
- **WorldCat-OCLC**
- **eLIBRARY.ru**
- **Agricola**
- **Agris**
- Academic Journals Database
- Ulrich's Periodicals Directory
- OALsters Directory
- HINARI
- Bielefeld Academic Search Engine (BASE)

Ukrainian Journal of Ecology is committed to working toward a business model that:

Allows the dissemination of peer-reviewed manuscripts containing original research or scholarship immediately upon publication, without requiring registration or other restrictions to access.

Requires copyright holders to allow users to “copy, use, distribute, transmit, and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship”.

Ukrainian Journal of Ecology

Editorial Board

Editorial and Advisory Board

Matsyura O.V

Altai State University, Barnaul, Russia

Deputy Chief Editor

Brygadyrenko V.V

Oles Honchar Dnipropetrovsk National University, Dnipropetrovsk, Ukraine

Yakovlev R.V

Altai State University, Barnaul, Russia

Shmakov A.I

Altai State University, Head South-Siberian Botanical Garden, Russia

Milan Vogrin

Slovenian Bird Research and Nature Protection (DPPVN), Slovenia

Eugene Maltsev, PhD

Professor

Melitopol Bogdan Khmelnytskyi State Pedagogical University, Getmanska, Melitopol, Ukraine

Jan Van Der Winden

Bureau Vaardenburg, Netherlands

Editorial Board

Jizhou Jiang

Distinguished Professor, School of Environmental Ecology and Biological Engineering,
Wuhan Institute of Technology
Wuhan 430205, P.R. China

Professor Dr Hab. Janusz Uchmanski

Centre for Ecological Research. Polish Academy of Sciences
Poland

Dr. Slawomir Ligeza

Institute of Soil Science Environment Engineering and Management University of Life
Sciences in Lublin, Poland

Dr. Golawski Artur

Siedlce Univesrsity of Natural Sciences and Humanities, Siedlce, Poland

Dr. Seyed Mehdi Talebi

Department of Biology, Arak University., Iran

Dr. Kasprzykowski Zbigniew

Siedlce Univesrsity of Natural Sciences and Humanities, Siedlce, Poland

Former title is "Bìologìčnij vìsник Melìtopol's'kogo deržavnogo pedagogìčnogo universitetu imeni Bogdana Hmel'nic'kogo" that is available at <https://www.ujecology.com/archive.html> (in section "Archive").

The "Ukrainian Journal of Ecology" (the former title "Bìologìčnij vìsник Melìtopol's'kogo deržavnogo pedagogìčnogo universitetu imeni Bogdana Hmel'nic'kogo") published in print and online versions from 2011 to 2016.

- [Retraction Statement](#)



1 - 1

Volosyanko, O.V., Kurilo, V.I., Kravchuk, M.Y

DOI: -

[Abstract](#)

- [Analysis of the duration of the vegetation period and phases of development of Somaclonal lines of *Camelina sativa*](#)



1 - 5

A. Liubchenko, I. Liubchenko, Ia. Riabovol, L. Riabovol, O. Serzhuk, O. Chernov, L. Vyshnevskaya

DOI: 10.15421/2020_124

[Abstract](#)

- [The impact of cow keeping technologies on milk production of cows and their protection against midges in summer](#)



6 - 11

O. A. Fiodorova, E. I. Sivkova, M. I. Serkova

DOI: 10.15421/2020_125

[Abstract](#)

- [The sensitivity of the strains of the pathogen *B. anthracis* and Anthrax-like Bacilli for Antibiotics](#)



12 - 18

H.A. Zaviryukha, T.B. Vasylieva, U.M. Yanenko, V.A. Synytsyn, N.I. Kosyanchuk, N. H. Sorokina, O.L. Kravtsova, L.M. Muzykina, O.O. Marchuk

DOI: 10.15421/2020_126

[Abstract](#)

- [Ensuring environmental safety of the food industry: Influence on leadership positions in the economy](#)



19 - 23

O. Radchenko, V. Streltsov, T. Shestakovska, O. Radchenko, S. Chernov

DOI: 10.15421/2020_127

[Abstract](#)

- [Biological, Trophological, Ecological and Control Features of Horse-Chestnut Leaf Miner \(*Camptorhiza ohridella* Deschka & Dimic\)](#)



24 - 27

N. Lesovoy, V. Fedorenko, S. Viger, P. Chumak, M. Kliuchevych, S. Stoliar, M. Retman

DOI: 10.15421/2020_128

[Abstract](#)

- [Evolution of the microbial population of a cultivated soil with organic matter input under semi-arid conditions \(Tiaret, Algeria\)](#)



28 - 35

S. Benouadah, K. Oulbachir, L. Benaichata, M.D. Miara, J. Snorek

DOI: 10.15421/2020_129

[Abstract](#)

- [Forecasting of winter wheat \(*Triticum aestivum* L.\) yield for the Southern Steppe of Ukraine using meteorological indices](#)



36 - 43

Z. Bilousova, Yu. Klipakova, V. Keneva, O. Priss

DOI: 10.15421/2020_130

[Abstract](#)

- [Effect of indoor light on quail meat productivity](#)



44 - 47

S. Bazyvoliak, N. Prokopenko, L. Konoval, V. Melnyk

DOI: 10.15421/2020_131

[Abstract](#)

- [Morphology and productivity of tarragon \(*Artemisia dracunculus* L.\) in Central Polissya \(Ukraine\)](#)



48 - 55

I. Ivashchenko, L. Kotyuk, A. Bakalova

DOI: 10.15421/2020_132

[Abstract](#)

- [Effectiveness of additional mechanical ventilation in naturally ventilated dairy housing barns during heat waves](#)



56 - 62

O. Izhboldina, R. Mylostyvyi, O. Khramkova, O. Pavlenko, N. Kapshuk, O. Chernenko, A. Matsyura, G. Hoffmann

DOI: 10.15421/2020_133

[Abstract](#)

- [Application of mannan oligosaccharides \(Alltech Inc.\) in waterfowl: Optimal dose and effectiveness](#)



63 - 68

O.I. Kasianenko, S.M. Kasianenko, A.P. Paliy, R.V. Petrov, M.D. Kambur, A.A. Zamaziy, L.P. Livoshchenko, Ye.M. Livoshchenko, S.M. Nazarenko, Zh.E. Klishchova, A.P. Palii

DOI: 10.15421/2020_134

[Abstract](#)

- [Ecological impact of phytovasions in Ukraine](#)



69 - 75

V.V. Konishchuk, I.V. Solomakha, O.V. Mudrak, H.V. Mudrak, O.B. Khodyn

DOI: 10.15421/2020_135

[Abstract](#)

- [Effect of colostrum bacterial contamination on the calves](#)



76 - 82

Ді. P. Palii, K.O. Rodionova, A.P. Palii, L.L. Kushch, O.V. Matsenko, M.D. Kambur, A.A. Zamaziy, L.V. Plyuta, Y.A. Baidevliatov, A.V. Kolechko, H.O. Honcharenko

DOI: 10.15421/2020_136

[Abstract](#)

- [Enhanced cultivation technology for lacto- and bifidobacteria](#)



83 - 87

A.P. Palii, S.A. Gujvinska, K.O. Rodionova, N.V. Alekseeva, O.V. Ponomarenko, M.S. Alrawashdeh, T.A. Yeletskaya, G.V. Ponomarenko, V.Yu. Kushnir, A.P. Palii

DOI: 10.15421/2020_137

[Abstract](#)

- [Effect of linear traits in dairy cows on herd disposal](#)



88 - 94

Ді. P. Palii, O.I. Shkromada, N.I. Todorov, N.P. Grebenik, A.B. Lazorenko, I.V. Bondarenko, Y.A. Boyko, O.V. Brit, T.L. Osipenko, O.Yu. Halay, A.P. Palii

DOI: 10.15421/2020_138

[Abstract](#)

- [Influence of new frost-resistant disinfectant on the ultrastructural organization of atypical mycobacteria](#)



95 - 101

A.P. Palii, A.I. Zavgorodnii, M.V. Kalashnyk, O.I. Shkromada, Z.V. Rybachuk, R.V. Dolbanosova, L.M. Kovalenko, Ye.M. Livoshchenko, L.P. Livoshchenko, Yu.V. Baidevliatova, Yu.K. Dunaiev, A.P. Palii, T.I. Nedzheria

DOI: 10.15421/2020_139

[Abstract](#)

- [Influence of temperature on the aquatic biota](#)



102 - 105

N.Ya. Rudyk-Leuska, N.Yu. Yevtushenko, M.I. Khyzhniak, M.V. Leuskyi, R.V. Kononenko, N.I. Tson, O.Y. Dumych

DOI: 10.15421/2020_140

[Abstract](#)

- [Species compositions of root rot agents of spring barley](#)



106 - 109

D. T. Gentosh, M. M. Kyryk, I. D. Gentosh, M. Y. Pikovskyi, V. M. Polozhenets, S. V. Stankevych, L. V. Nemerytska, I. A. Zhuravska, I.V. Zabrodina, L. V. Zhukova

DOI: 10.15421/2020_141

[Abstract](#)

- [Environmental pollution caused by the manure storage](#)



110 - 114

O.O. Borshch, B. V. Gutyj, O.V. Borshch, O.I. Sobolev, S.V. Chernyuk, O.P. Rudenko, B.M. Kalyn, N.A. Lytvyn, L.B. Savchuk, L.P. Kit, T.B. Nahirniak, S.I. Kropyvka, T.O. Pundyak

DOI: 10.15421/2020_142

[Abstract](#)

- [Species composition, morphological and biological peculiarities of leaf pathogens of spring wheat](#)



115 - 120

V.V. Horiainova, V.P. Turenko, M.O. Bilyk, S.V. Stankevych, L.V. Zhukova, O.M. Batova, V.I. Martynenko, Ye.Yu. Kucherenko, A.M. Zviahintseva

DOI: doi: 10.15421/2020_143

[Abstract](#)

- [Infrared spectroscopy of copper-poisoned rat liver](#)



121 - 123

I.V. Kalinin, V.A. Tomchuk, V.A. Bogatyrenko, V.V. Liventsov

DOI: 10.15421/2020_144

[Abstract](#)

- [Effect of fertilization on Solanum tuberosum L. productivity in Ukrainian Polissya](#)



124 - 130

T.V. Klymenko, S.V. Fedorchuk, O.I. Trembitska, S.V. Zhuravel, V.G.Radko, I.Y. Derebon, M.M. Lisovyy, O.O. Didur, Y.V. Lykholat

DOI: 10.15421/2020_145

[Abstract](#)

- [Effectiveness of aldehyde disinfectant "DZPT-2" against the African swine fever virus](#)



131 - 138

A.P. Paliy, B.T. Stegnyy, A.V. Kuzminov, A.I. Buzun, A.P. Gerilovich, M.V. Bogach, M.Y. Stegnyy

DOI: 10.15421/2020_146

[Abstract](#)

- [Functional asymmetry in cattle ovaries and donor-recipients embryo](#)



139 - 146

L. Roman, S. Sidashova, O. Danchuk, I. Popova, A. Levchenko, V. Chorny, O. Bobritska, B. Gutyj

DOI: 10.15421/2020_147

[Abstract](#)

- [Cycle populations dynamics of harmful insects](#)



147 - 161

S.V. Stankevych, Ye.M. Biletskyj, I.V. Zabrodina, M.D. Yevtushenko, M.M. Dolya, I.P. Lezhenina, H.V. Baidyk, M.O. Filatov, L.A. Sirous, V.O. Melenti, O.A. Molchanova, L.V. Zhukova, L.V. Golovan, V.M. Polozhenets, L.V. Nemerytska, I.V. Klymenko

DOI: 10.15421/2020_148

[Abstract](#)

- [Nanotechnologies and environment: A review of pros and cons](#)



162 - 172

O.S. Tsekhmistrenko, V.S. Bityutskyy, S.I. Tsekhmistrenko, V.M. Kharchishin, O.M. Melnichenko, O.I. Rozputnyy, V.V. Malina, N.M. Prysiashniuk, Y.O. Melnichenko, P.I. Vered, O.P. Shulko, L.S. Onyshchenko

DOI: 10.15421/2020_149

[Abstract](#)

- [Efficiency of alfalfa granulated feed additive in balanced ration of Ukrainian Riding Horse](#)



173 - 180

K.D. Dynnikova, O.V. Lesnovskaya, L.V. Karlova, O.G. Gavrilina

DOI: 10.15421/2020_150

[Abstract](#)

- [Effect of mannan oligosaccharides on productivity and quality of slaughter pig products](#)



181 - 186

O. Kuzmenko, V. Bomko, A. Horchanok, S. Babenko, O. Tytariova, M. Slomchynskiy, V. Khalak, S. Polishchuk, O. Cherniavskiy, N. Prysiashniuk, L. Lytvshchenko

DOI: 10.15421/2020_151

[Abstract](#)

- [Soil ciliates of the Goygol National Park](#)



187 - 190

V.F. Mammadova, L.R. Abdullayeva, V.M. Mammadov

DOI: 10.15421/2020_152

[Abstract](#)

- [Vegetative status of children as a territorial bio-indicator of ecological safety](#)



191 - 196

O.I. Furdychko, O.V. Mudrak, O.V. Yermishev, H.V. Mudrak

DOI: 10.15421/2020_153

[Abstract](#)

- [Effect of the water regime, crop rotation and fertilizers in biogenic matters leaching into ground water and surface water](#)



197 - 200

I.T. Slyusar, O.P. Solyanik, V.O. Serbenyuk, V. Viryovka, O.A. Tarasenko

DOI: 10.15421/2020_154

[Abstract](#)

- [Test of antimicrobial activity of morpholine 2-\(5-\(3-fluorophenyl\) -4-amino-1,2,4-triazol-3-ylthio\) acetate \(BKP-115\) by experimental model of pancreatitis in rats](#)



201 - 207

O.A. Bigdan, V.V. Parchenko, B.P. Kyrychko, T.V. Zvenigorodska, B.V. Gutyj, A.V. Gunchak, L.G. Slivinska, L.B. Savchuk, N.V. Nazaruk, L.P. Kit, O.O. Dashkovskyy, Z.A. Guta

DOI: 10.15421/2020_155

[Abstract](#)

- [137 Cs contaminations in wild-growing medicinal plants of Zhytomyr polissya forests: A 34 years after Chernobyl accident](#)



208 - 215

I. Davydova, A. Panasiuk, V. Melnyk, L. Davydova

DOI: 10.15421/2020_156

[Abstract](#)

- [Influence of farm conditions on sows morphological blood indicators](#)



216 - 220

O. Kozenko, N. Krempa, A. Vysotskij, V. Shnaider, L. Yevtukh, G. Gryshchuk, V. Todorik

DOI: 10.15421/2020_157

[Abstract](#)

Vegetative status of children as a territorial bio-indicator of ecological safety

O.I. Furdychko¹, O.V. Mudrak*², O.V. Yermishev³, H.V. Mudrak⁴

¹*Institute of Agroecology and Environmental Management NAAS of Ukraine,
12 Metrolohichna St, Kyiv, 03143, Ukraine,*

²*Vinnitsia Academy of Continuing Education, 13 Hrushevskiyi St, Vinnitsia, 21050, Ukraine,*

³*Vasyl' Stus Donetsk National University, 21 600-Richya St, 21021, Vinnitsia, Ukraine,*

⁴*Vinnitsia National Agrarian University, 3 Soniachna St, Vinnitsia, 21008, Ukraine*

*Corresponding author E-mail: ov_mudrak@ukr.net

Received: 15.06.2020. Accepted 31.07.2020

The quantity of environment contaminators (pollutants) and their combinations cannot be counted and specified. Consequently, the current situation needs a change of principles of ecological control. In our case, the indicators of functional health of child population and levels of its vegetative disorders appear as integral bioindicators of individual health (dynamic stability of functional-vegetative homeostasis) and characterize the ecological dynamics in regions of compact settlement. Environmental certification of children functional health could define the region with a pre-crisis or crisis state of the environment. Vegetative levels (vegetative coefficients, k-V of functional-vegetative homeostasis testify to vegetative health (norm), or prevalence of sympathetic and parasympathetic activity. Permanent functional voltage distorts the pathogenesis of functional-vegetative adaptation and requires specific monitoring in the form of "Functional-ecological expertise" (FEE) of selected staff. The basis of the FEE methodology developed by us is "Functional-vegetative diagnostics" (FVD) by the method of V.G. Makats. The diagnostic complex "BIOTEST-12M" (Diagnostic complexes VITA-01-M and computerized system VITA-01-Biotest) serves as the technical tool of the FVD. Indicators of - vegetative coefficients ($k-V = \Sigma SA: \Sigma PSA$; (levels of vegetative balance, sympathetic, or parasympathetic activity) act as integral bioindicators of internal homeostasis and its dependence on the conditions of the environment. The criterion of FEE is a systemically dependent comparison of inhibition of the functional activity of the organism (parasympathetic activity (PA), vegetative equilibrium (VE) and sympathetic activity (SA) and can be calculated for children in particular region. This, we suggested the integral characteristic of territorial ecological state and the levels (zones) of ecological pressure.

Key words: Vegetology; Vegetative Nervous System (VNS); Functional-vegetative homeostasis; Functional-vegetative diagnostics (FVD); Children

Introduction

The anthropoecological approach is promising for environmental indication. It can evaluate the impact of environmental conditions on a population: its spatial structure, population dynamics, gene pool, adaptive capabilities, growth, development and aging processes (Van den Brink et al., 2018). It was established that environmental factors gain one of the first places among the factors affected the health (genetic, climatic, endemic, epidemiological, professional, social) (Prescott et al., 2019; Góralczyk & Majcher, 2019). The analysis of the influence of environmental factors on human health (neutral, positive, negative) should be carried out using any units of measurement. What parameters do adequately characterize the anthropoecological status of the area.

One of the most important areas it is the analyze of regional population incidence. However, firstly, a sufficient number of people are often observed in medical institutions outside their area and there is no statistics on their diseases in the community. Secondly, the diseases are often associated with the side effects of medical pharmaco-chemical agents (up to 30% of hospital days), and this does not directly affect the influence of negative environmental factors. Thirdly, it is impossible to accurately determine the share of the "guilt" of the regional environmental situation in the development of most diseases. Fourth, many diseases (for example, oncological diseases) occur latently for decades and, due to the time gap between the onset of the disease and its clinical manifestations, cannot be used as an adequate anthropoecological criterion. Fifth, the picture of morbidity is distorted by the fact that some of the working-age population today is out of economic considerations (low pay for disability days, the threat of reductions, etc.) does not seek help from medical institutions. Thus, the incidence rates of the population of a particular region cannot be an exhaustive argument of the environmental characteristics of a given territory.

An important task of the hygienic assessment of the "environment - health" system is to determine the complex anthropogenic load (Rezende & Bozinovic, 2019). Complex anthropogenic man-made urban environment consists of multifactor indicators - quantitative characteristics of the main environmental factors that determine the real load on the human body (Hennig et al., 2018). These are indicators of chemical and biological pollution of air, water and soil, level of noise, electromagnetic and ionizing radiation (WHO, 2016; Iszatt et al., 2016; Spicer et al., 2019). The determined value of the complex load on the body can be quantified by one indicator related to the hygienic standard - in this case, a value equal or less than acceptable level. The development of methods for the rapid medical diagnosis of large population is currently difficult; however, certain conceptual principles of its organization can be

identified. Along with anthropometric data and heart rate variability indicators, the methods of electro-puncture diagnostics (EPD) are widely used to assess the level of population health (Makats et al., 2018). The basis of these methods is the theory of close relationship between the functional state of the internal organs and human systems with electrical resistance at certain biologically active zone (points) (BAZ) on the surface of the body. Scientific substantiations have been found for many concepts and laws of ancient oriental physicians, though acupuncture and reflex diagnosis are recognized by WHO as scientific and recommended issue in public health practice. The existence of the projection of the internal organs on the skin, the auricle, the iris, the surface of the tongue has been proved. The interrelation between internal organs and skin is confirmed by the presence of Zakharyin-Ged zones, pain points of Mac-Burney, Mac-Kenzie, Vidal, and Boas. Obviously, the most indicative "indicator" of environmental distress is the children's organism (Zheng et al., 2016; Vrijheid et al., 2016). Children are the most convenient objects for medical and environmental monitoring, as their bodies react to lower concentrations of toxic substances more quickly than the adult's body, and therefore children are more susceptible to regional environmental factors. Besides, they practically do not leave the living area. Children's body is also a marker of hypersensitivity to xenobiotics (Russ & Howard, 2016). Biological monitoring and identification of children with hypersensitivity to chemical agents is more important than expanding the environmental monitoring programs to determine the concentration of various chemical agents.

Apart from environmental influences, the adult deal with many other important factors: work activity (10–15 hours during the day with travel time) outside the area of residence, professional and interpersonal conflicts, financial distress, career problems, and ingrained irrational stereotypes of behavior. Thus, we can conclude that ratio of environmental factors affected the children is much greater than for the adults.

Material and Methods

The methodology of functional-vegetative diagnostics (FVD) elaborated by V. G. Makats (2016) allowed to identify acupunctural channels and discovers a previously unknown human functional-vegetative system. This method was approved for application in medical practice by the Academic Council of the Ministry of Health of Ukraine and by the joint session of the State Problem Commissions (SPC) of Paediatrics, Obstetrics and Gynaecology, Quantum Medicine, Haematology and Transfusiology, New Medical Technology and New Diagnostic Tools (Minutes No. 1, 08–01 of 11 September 1994).

Currently, this is the only "electropunctural" diagnostics, results of which are stable and comparable in time. It is based on previously unknown biophysical phenomena. "Electropunctural" diagnostics has original standardization and is directed at the evaluation of functional-vegetative homeostasis: correlation of syndromes of sympathetic (YANG) and parasympathetic (YIN) activity. The diagnostic complex "BIOTEST-12M", which consists of two diagnostic complexes VITA-01-M and the computerized system VITA-01-Biotest, serves as the technical component of the FVD. The latter does not use traditional external power sources and the SPC "New medical technology and new methods of diagnostics, prevention and rehabilitation" by the Ministry of Health of Ukraine (Minutes No. 5 of 25 December 25 1991) and Scientific Council of Ministry of Health of Ukraine (record No. 1. 08–01, 11 January 1994) was approved for practical use.

The reliability of the obtained data was estimated by means of parametric and nonparametric statistics. The analysis of the results was carried out with computer programs "Search". The system VITA-01-M does not require metrological standardization because (Makats et al., 2016; Yermishev, 2019): (1) the FVD methodology does not require external sources of power; (2) the voltage of the closed individually-diagnostic circuit does not exceed the level of the membrane potential (0.03–06 V); (3) analysis is needed not for absolute values of diagnostic indices, but for a relative correlation of the total activity of functional systems of YANG/YIN groups (syndromes of sympathetic/parasympathetic activity of functional systems). Reasonability of functional-vegetative examination of children is confirmed by the programme "A two-stage system for rehabilitation of vegetative disorders in children residing in the zone of ecological control of Ukraine" (conducted according to the Resolution of the Cabinet of Ministers of Ukraine No. 1861/4, 4 April 1997 and No. 12010/87, 01 June 1999). The received data in mV (millivolts) or in mA (microampere) of FVD is transformed into average values.

Changes in the physiological state of the body are manifested by the transformation of electro-skin resistance in certain functionally-active zones (FAZ) of the skin, which topographically coincide with the course of 12 classical acupuncture meridians (functional systems) – the bladder (BL), the gall bladder (GB), the stomach (ST), the small intestine (SI), the lymphatic system (TE), the large intestine (LI), which form a sympathetic orientation of the autonomic balance, and the spleen and pancreas (SP), the liver (LR), the kidney (KI), the lungs (LU), the pericardium (PS), and the heart (HT), which form the parasympathetic orientation of the autonomic balance. The relative ratio of the sum of indicators of total sympathetic activity to parasympathetic activity determines the orientation of the vegetative balance. The correlations between changes in electrical conductivity in 24 representative FAZ (characterizing the state of the meridian as a unity) and the state of classical acupuncture meridians "determining" the functional state of their respective internal organs and systems of the organism are used for the diagnosis. We determined the overall bioelectric activity of functional systems of SA and PA groups, and the vegetative coefficient of their interdependency ($k-V = \sum SA : \sum PA$) (Makats et al., 2017; Yermishev, 2017). From the point of view of vegetative homeostasis, the latter points to the correlation of sympathetic and parasympathetic functional activity. Functional autonomic systems ("acupuncture channels") are based on the international acupuncture nomenclature (IAN) suggested by the WHO.

The following zones (levels) of functional-vegetative homeostasis are scientifically based on the coefficients of functional-vegetative homeostasis (Table 1). FVD was held twice in the first half of the day (from 10:00 till 12:00). The bioelectric activity of 12 symmetric pairs of functional active skin zones (24 FAZs) was studied. Attention was drawn to the dynamics of the levels of the vegetative equilibrium (LVE) and to the direction of the dispersion of levels of integral vegetative homeostasis over the years of life.

Results and Discussion

It would be perfectly great if we immediately draw attention at the fact that the quantity of environment contaminators (pollutants) and their combinations cannot be counted and specified. That is why, current situation needs a change of principles of ecological control. One of them is "bioindication", which is conditioned by integral response of organism to ecological influence (Serrano & Oliveira et al., 2019). In our case, indicators of functional health of child population and levels of its vegetative disorders appear as integral bioindicators of individual health (dynamic stability functional-vegetative homeostasis) and characterize ecological dynamics in the region of compact habitation. Environmental certification of the functional health of the children population locates the region

with a pre-crisis or crisis state of the environment. It predicts the functional health of children and their dependence on environmental pressures (prevention of critical situations).

Table 1. Zone (levels) of functional-vegetative homeostasis.

Value of k	Zone of functional attention	Symbol of zone
to 0.75	syndrome of significant parasympathetic prevalence	PA-s
0.76-0.86	syndrome of expressed parasympathetic prevalence	PA-e
0.87-0.94	functional compensation zone of the parasympathetic activity	FcP
0.95-1.05	zone of functional vegetative equilibrium	VE
1.06-1.13	zone of functional compensation of sympathetic activity	FcS
1.14-1.26	syndrome of expressed sympathetic prevalence	SA-e
≥ 1.26	syndrome of significant sympathetic prevalence	SA-s

Vegetative levels (vegetative coefficients (k-V) of functional-vegetative homeostasis testify to vegetative health (norm), or prevalence of sympathetic and parasympathetic activity. A modern feature was the daily environmental-negative pressure on the health of the children's population. Radiation pollution of the environment, household electromagnetic smog, pollutants of anthropogenic origin and psychosocial stress cause permanent "integral environmental stress" (IES). Its initial influence manifests itself at the functional level and forms the basis of "endoecology". Permanent functional voltage distorts the pathogenesis of functional-vegetative adaptation and requires specific monitoring in the form of "Functional-ecological examination" (FEE) of selected staff. The basis of the FEE methodology developed is "Functional-vegetative diagnostics" (FVD) by the method of V.G. Makats and corresponds to the Human Strategy for Survival, agreed at the 2-nd UN conference on "Development and the Environment" (Rio de Janeiro, 1992) (Makats et al., 2017; Yermishev, 2017).

The criterion of the FEE of a particular region of residence of the children is a systemically dependent comparison of inhibition of the functional activity of the organism (parasympathetic activity (PA), vegetative equilibrium (VE) and sympathetic activity (SA). On this basis, an integral characteristic of the ecological state is formed and the levels (zones) of its ecological pressure.

Indicators of Functional-vegetative diagnostics (FVD) using the method of V.G. Makats - vegetative coefficients (k-V = ΣSA : ΣPA ; (levels of vegetative balance, sympathetic, or parasympathetic activity) act as integral bioindicators of internal homeostasis and its dependence on the conditions of the environment.

For functional-ecological expertise (estimation) of settlements and territories of environmental control, indicators of vegetative dispersion (scattering of vegetative levels).

Today seven levels of vegetative dispersion (dispersion) children's functional health have been highlighted (Table 1). Vegetative variance (VD) documentally visualizes the state of functional health of the child population. The second (more informative) index of variance of levels of vegetative equilibrium (LVE) serves their distribution in "critical zones". Under the term "critical zones" (KZ) there are three groups of conditionally united of levels of vegetative equilibrium (LVE):

- in the zone of admissible vegetative (functional) equilibrium (VE), enter total number of cases

$$\Sigma = FcP + VE + FcS;$$

- in the critical area of parasympathetic activity (PA) enters total number of cases $\Sigma = PAs + PAe$;

- in the critical area of sympathetic activity (SA) is included total number of cases $\Sigma = SAe + SAs$.

The ratio of the parameters of PA-VE-SA testify to the state of the ecological safety of the region and the activities of public health authorities (Makats et al., 2017; Yermishev, 2017).

The zone (region) of ecological control (functional health) forms the parasympathetic (PA), permissible vegetative equilibrium (VE) and sympathetic (SA) activity (Table 2).

Table 2. Dependence of the functional ecological disturbance of the territory on the state of averaged deviations of the autonomic nervous system.

Variables	PA	VE	SA
Zone of relative functional safety (RFS)	15	70	15
Zone of high functional attention (HFA)	25	50	25
Functional voltage development Zone (FVD)	30	50	20
Zone of functional disaster development (FDD)	45	40	15
Functional disaster zone (FD)	65	25	10
Functional protection voltage zone (FVP)	10	25	65

To evaluate the deviations of the indicators of functional vegetative coefficients (k-V) population, we have developed functional-vegetative norms (passports) for each age group, taking into account gender peculiarities.

Recognizing "Functional health" is environmentally dependent; let's consider its features in separate age groups. In this case, parasympathetic and sympathetic vegetative deviations will be evaluated as a violation of the mechanisms of adaptation (the ability to adapt to survival).

When analyzing the age structure of the population it is customary to allocate the following main age groups:

1. Pre-school age (first childhood) (PSA) 3-6 years;
2. Junior school age (Second childhood) (JSA) 7-11 years;
3. Adolescent school age (Teens) (ASA) 12-15 years;
4. Juvenile school age (Youth Period) (JvSA) 16-21 years;
5. Adult age (Mature age) (AA) 22-60 years

Pre-school age (first childhood) (PSA) 3-6 years: Age variance of vegetative levels (in %) by functional zones of preschool age (3-6 years) indicates the following (Table 3): in the zone of PA there are 28,3/35,6% of the examined children; in the VE zone 59,3/47,3%; in the zone SA 12,5/17,1% (Yermishev, 2019).

Table 3. Vegetative dispersion by Functional zones of pre-school age (PSA) in %.

Years of life	PA (PAs + PAe)	VE (FcP + VE + FcS)	SA (SAe + SAs)
3	24,1/66,3	72,4/22,2	3,4/11,1
4	17,4/20,9	69,6/62,8	13,0/16,3
5	23,9/27,4	52,2/53,2	23,9/19,4
6	47,6/27,7	42,9/50,8	9,5/21,5
M = 3-6	28,3/35,6	59,3/47,3	12,5/17,1

Here and below: */* female/male group; PA - Zone of parasympathetic activity, VE - Zone functional equilibrium, SA - Zone of sympathetic activity

With each passing year, the number of cases of PA increases, and FE - decreases. In this case, prolonged vegetative disorders (the advantage of parasympathetic, or sympathetic activity) form pathogenetic mechanisms of future functional disorders.

Junior school age (Second childhood) (JSA) 7-11 years: Vegetative age variance over the functional zones of the junior school age (JSA, 7-12 years) indicates the following (Table 4): in PA zone here are 30.9/27.6% of the examined children; in VE zone 50.4/56.0%; in SA zone 18.4/12.9%.

Table 4. Vegetative dispersion by Functional zones of junior school age (JSA) in %.

Years of life	PA (PAs+PAe)	VE (FcP + VE + FcS)	SA (SAe + SAs)
7	30.7/24.8	50.0/60.4	19.3/4.0
8	28.3/23.3	50.0/57.9	19.7/18.8
9	31.7/24.4	51.3/59.1	17.0/16.5
10	28.5/28.6	52.4/54.1	19.1/17.3
11	34.3/31.8	47.9/53.6	17.8/14.6
12	31.8/32.8	50.9/51.0	17.3/6.2
M = 7-12	30.9/27.6	50.4/56.0	18.4/12.9

By the years of life of JSA, the sexage characteristics of the vegetative dispersion have been detected.

Adolescent school age (Teens) (ASA) 12-15 years: Age variance of vegetative levels (in %) by functional zones of adolescent school age (12-15 years) indicates the following (Table 5): in the zone of PA there are 36,4/34,0% of the examined children; in the VE zone 49,9/52,9%; in the zone SA 15,8/13,8%.

Table 5. Vegetative dispersion by Functional zones of adolescent school age (ASA) in %.

Years of life	PA (PAs + PAe)	VE (FcP + VE + FcS)	SA (SAe + SAs)
13	36.0/31.6	47.9/52.5	16.1/15.9
14	33.0/36.8	51.8/53.1	15.2/10.1
15	33.9/31.4	49.9/53.1	16.2/15.5
M = 12-15	36.4/34.0	49.9/52.9	15.8/13.8

By the years of life of ASA, the sexage characteristics of the vegetative dispersion have been detected and relative sexual-age stabilization of vegetative dispersion.

Juvenile school age (Youth Period) (JvSA) 16-21 years: Age variance of vegetative levels (in %) in the functional zones of adolescence (16-21 years) indicates the following (Table 6): in the area of PA there is 24,7/42,2% of the examined children; in the zone of VE 56,4/39,3%; in the zone of SA 18,6/18,5%."

Vegetative dispersion of the Juvenile school age has pronounced sexual age features:

- With each passing year, the number of cases of PA in the male group increases, and in the female, on the contrary, decreases.
- With each passing year, the number of cases of VE in the male group decreases, and in women is predominantly increasing.

Adult age (Mature age) (AA) 22-60 years Age variance of vegetative levels (in %) by functional zones of adult age (21-60 years) indicates the following (Table 7): in the zone of PA there are 46,7/53,8% of the examined; in the VE zone 40,8/37,5%; in the zone SA 12,5/8,8%.

Table 6. Vegetative dispersion by Functional zones of juvenile school age (JvSA) in %.

Years of life	PA (PAs + PAe)	VE (FcP + VE + FcS)	SA (SAe + SAs)
16	25.3/35.3	57.0/55.0	16.3/9.7
17	17.5/28.4	57.7/58.0	24.7/13.6
18	18.2/40.0	62.0/30.0	19.8/30.0
19	17.7/50.0	58.9/25.0	23.5/25.0
20	45.0/57.1	46.4/28.6	8.6/14.3
21	23.9/56.2	45.3/29.1	9.0/15.4
M = 16-21	24.7/42.2	56.4/39.3	18.6/18.5

Table 7. Vegetative dispersion by Functional zones of adult age (AA) in %.

Years of life	PA (PAs + PAe)	VE (FcP + VE + FcS)	SA (SAe + SAs)
M = 21-60	46.7/53.8	40.8/37.5	12.5/8.8

Over the years of life, the sex-age characteristics of the vegetative dispersion have been detected. With each passing year, the number of cases of PA increases, and VE and CA - decreases.

The current state of the human environment in Ukraine is quite complex and causes considerable concern. Although it should be noted positive changes in this aspect: reduction of air pollution by harmful substances, including sulfur dioxide, nitrogen dioxide, methane and other hazardous compounds (Mudrak, 2008); increase in capital investments in environmental protection and rehabilitation; introduction of ecological education of the younger generation (Mudrak & Mudrak, 2017).

The modern environmental situation in Ukraine has the problems appeared some decades ago. Therefore, the prospects for improving the environment now depend not so much on the intention to take environmental measures, but on the real possibilities of eliminating the consequences of the already caused environmental damage and creating a system of continuing environmental education (Mudrak & Mudrak, 2019).

Multicomponent and multifunctional system environment-health of the population requires non-standard approaches to the study of its inherent phenomena and interactions of factors. The solution of the problem undoubtedly requires the training of heads of state structures, the application of the methodology of integrated environmental monitoring, associated with multifactor analysis of the whole set of environmental components and a set of indicators that characterize the health of the population (Mudrak et al., 2019). The study of the ecological condition of the territory and the morbidity of the population is the basis for a deeper understanding of the relationships between these parameters, which allows to develop sanitary and health and anti-epidemic measures. The obtained results help to implement the most effective of them, as well as to implement appropriate scientifically sound proposals for their practical implementation by government agencies, enterprises, institutions and organizations.

Conclusion

Functional-vegetative health of children is ecologically dependent, is a bioindicator and is the basis of functional-ecological expertise (FEE) of the regions of ecological control. The suggested research method is non-invasive and low-cost, which allows conducting surveys of different age and sex groups and obtaining data with a minimum statistical error.

The proposed method is extremely promising in bioindication of territories contaminated with radionuclides, chemical means of plant protection, territories with contaminated objects of the hydrosphere and atmosphere, allows to estimate the total effects of all negative environmental factors on human health. The program of FEE allows grounding expert assessment of the region of habitation of children according to the indications of individual functional health. From governmental point of view, FEE personifies a certain region and characterizes the appropriate efforts of local authorities (dynamics of indexes of functional health of children would point to their quality).

References

- Góralczyk, K., & Majcher, A. (2019). Are the civilization diseases the result of organohalogen environmental pollution? *Acta biochimica Polonica*, 66(2), 123–127. https://doi.org/10.18388/abp.2018_2776.
- Henderson, K., & Loreau, M. (2018). How ecological feedbacks between human population and land cover influence sustainability. *PLoS computational biology*, 14(8), e1006389. <https://doi.org/10.1371/journal.pcbi.1006389>
- Hennig, B., Petriello, M.C., Gamble, M.V., Surh, Y.J., Kresty, L.A., Frank, N., Rangkadilok, N., Ruchirawat, M., & Suk, W.A. (2018). The role of nutrition in influencing mechanisms involved in environmentally mediated diseases. *Reviews on environmental health*, 33(1), 87–97. <https://doi.org/10.1515/reveh-2017-0038>
- Iszatt, N., Stigum, H., Govarts, E., Murinova, L.P., Schoeters, G., Trnovec, T., Legler, J., Thomsen, C., Koppen, G., & Eggesbø, M. (2016). Perinatal exposure to dioxins and dioxin-like compounds and infant growth and body mass index at seven years: A pooled analysis of three European birth cohorts. *Environment international*, 94, 399–407. <https://doi.org/10.1016/j.envint.2016.04.040>
- Makats, V.G., Nahaychuk, V.I., Makats, E.F., Yermishev, O.V. (2017a). Unknown Chinese acupuncture (problems of vegetative pathogenesis). Vol. IV. Vinnytsia: Nilan-LTD (in Ukrainian).
- Makats, V.G., Kuryk, M.V., Petruk, V.G. Nahaychuk, V.I., Yermishev, O.V. (2017b). Unknown Chinese acupuncture. Bases of Functional-ecological examination (problems of vegetative pathogenesis). Vol. VI. Vinnytsia: Nilan-LTD (in Ukrainian).
- Mudrak, O.V. (2008). Environmental safety of Vinnytsia region. Vinnytsia (in Ukrainian).
- Mudrak, O.V., Mudrak, G.V. (2017). Environmental policy as a priority component of the strategy of sustainable development of Vinnytsia region. Vinnytsia (in Ukrainian).
- Mudrak, O., Sobchuk, V., Nahorniuk, O., Mudrak, H., Yashnik, S., Tarasenko H. (2019). Environmental literacy of the leaders of the new formation in an open society. Mechanisms of stimulation of socio-economic development of regions in conditions of transformation. Opole: The Academy of Management and Administration in Opole (Poland).

- Mudrak, O.V., Mudrak, G.V. (2019). The system of continuous environmental education as a basis for sustainable development of Ukraine/Psychological principles of development, psychodiagnostics and personality correction in the system of continuing education. Proceedings of the IV Podolsk scientific-practical conference. 107–113 (in Ukrainian).
- Prescott, S.L., & Logan, A.C. (2019). Planetary Health: From the Wellspring of Holistic Medicine to Personal and Public Health Imperative. *Explore (New York, N.Y.)*, 15(2), 98–106. <https://doi.org/10.1016/j.explore.2018.09.002>
- Rezende, E.L., & Bozinovic, F. (2019). Thermal performance across levels of biological organization. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, 374(1778), 20180549. <https://doi.org/10.1098/rstb.2018.0549>
- Russ, K., & Howard, S. (2016). Developmental Exposure to Environmental Chemicals and Metabolic Changes in Children. *Current problems in pediatric and adolescent health care*, 46(8), 255–285. <https://doi.org/10.1016/j.cppeds.2016.06.001>
- Serrano, H.C., Oliveira, M.A., Barros, C., Augusto, A.S., Pereira, M.J., Pinho, P., & Branquinho, C. (2019). Measuring and mapping the effectiveness of the European Air Quality Directive in reducing N and S deposition at the ecosystem level. *The Science of the total environment*, 647, 1531–1538. <https://doi.org/10.1016/j.scitotenv.2018.08.059>
- Spicer, J.I., Morley, S.A., & Bozinovic, F. (2019). Physiological diversity, biodiversity patterns and global climate change: testing key hypotheses involving temperature and oxygen. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, 374(1778), 20190032. <https://doi.org/10.1098/rstb.2019.0032>
- Zheng, T., Zhang, J., Sommer, K., Bassig, B. A., Zhang, X., Braun, J., Xu, S., Boyle, P., Zhang, B., Shi, K., Buka, S., Liu, S., Li, Y., Qian, Z., Dai, M., Romano, M., Zou, A., & Kelsey, K. (2016). Effects of Environmental Exposures on Fetal and Childhood Growth Trajectories. *Annals of global health*, 82(1), 41–99. <https://doi.org/10.1016/j.aogh.2016.01.008>
- Van den Brink, P.J., Boxall, A., Maltby, L., Brooks, B.W., Rudd, M.A., Backhaus, T., Spurgeon, D., Verougstraete, V., Ajao, C., Ankley, G.T., Apitz, S.E., Arnold, K., Brodin, T., Cañedo-Argüelles, M., Chapman, J., Corrales, J., Coutellec, M. A., Fernandes, T. F., Fick, J., Ford, A.T., van Wensem, J. (2018). Toward sustainable environmental quality: Priority research questions for Europe. *Environmental toxicology and chemistry*, 37(9), 2281–2295. <https://doi.org/10.1002/etc.4205>
- Vrijheid, M., Casas, M., Gascon, M., Valvi, D., & Nieuwenhuijsen, M. (2016). Environmental pollutants and child health-A review of recent concerns. *International journal of hygiene and environmental health*, 219(4-5), 331–342. <https://doi.org/10.1016/j.ijheh.2016.05.001>
- World Health Organization (2016). Preventing disease through healthy environments: towards an estimate of the environmental burden of disease. https://www.who.int/quantifying_ehimpacts/publications/preventing-disease/en/
- Yermishev, O.V. (2018). The levels of functional-vegetative homeostasis as criteria for magnetotherapy efficacy. *International Journal of Medicine and Medical Research*, 4(1), 13-20.
- Yermishev, O. (2019). Peculiarities of functional-vegetative homeostasis of preschool-age females (first childhood). *Biologija*, 65(1), 56–65. <https://doi.org/10.6001/biologija.v65i1.3987>
- Yermishev, O.V., Makats, V.G., Petruk, V.G. (2017). The functional health of children as an environmental bio-indicator of Ukraine. *Vinnitsia: Nilan-LTD (in Ukrainian)*.

Citation:

Furdychko, O.I., Mudrak, O.V., Yermishev, O.V., Mudrak, H.V. (2020). Vegetative status of children as a territorial bio-indicator of ecological safety. *Ukrainian Journal of Ecology*, 10(3), 191-196.



This work is licensed under a Creative Commons Attribution 4.0. License