

SUBTROPICAL AND MOUNTAIN SOILS IN RESEARCHES OF GEORGIAN AND RUSSIAN SCIENTISTS

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A review of researches accomplished by Georgian and Russian scientists on subtropical and mountain soils is represented. The main results can be formulated as follows. 1. In the course of long-term investigation of subtropical and mountain soils in Georgia a scientific school of creative specialists has been formed which followed principles and methods of the Dokutchayev's genetic soil science. 2. In the course of studies of soils and soil cover in Georgia an effective cooperation of Georgian and Russian specialists in soil science, agricultural chemistry and land reclamation has been attained. 3. The Caucasus area went down in soil science history as a territory where the vertical soil zonality has been established for the first time and where many ideas concerning soil cover and soil and landscape geochemistry in mountain areas have been examined.

THE RESULTS OF BIOGEOGRAPHICAL STUDY OF ARCTO-TERTIARY REFUGIA (COLCHIS AND TALYSH) OF SOUTHERN CAUCASUS

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present article is a first attempt to a such interdisciplinary investigation. We analysed patterns of floristic and faunistic richness, endemism, including relict endemics, modern distribution of close relict species in other countries and regions of Northern Hemisphere, specificity of formation of two harbour territories of Tertiary organisms, palaeo-ecological data of the Black seacoastal and Caspian seacoastal regions, comparative analyses of the specificity of altitudinal zonation of Colchis and Talysh, at the same time comparing the structure of surviving in mentioned shelters two ancient elements of native flora and fauna – a) tropical-subtropical, b) organisms of the Arcto-Tertiary origination. Finally, critical analyse was dedicated to two refugial centres, which by some botanists are recognized as moist subtropic biocoenosis.

STEROIDAL GLYCOSIDES OF *TRIBULUS TERRESTRIS* L., *YUCCA GLORIOSA* L. AND THEIR APPLICATION AS PLANT GROWTH AND DEVELOPMENT PROMOTERS

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Promising steroidogenic plants have been identified and explored. From *Tribulus terrestris* the remedy Tribusponin for the treatment and prevention of atherosclerosis was developed and used in medical practice. Steroidal sapogenin tigogenin from the *Yucca gloriosa* leaves was considered as cost-effective raw material for the synthesis of 5 α -series steroid hormones. Crude steroidal glycosides named Alexin were obtained from the flowers of *Y. gloriosa*. Active substances of tribusponin and Alexin appeared effective stimulants of growth and development of plants. Pre-sowing treatment of crops and leguminous plants' seeds or spraying of seedlings of vegetables with low concentrations (0.002-0.005%) of aqueous solutions of tribusponin and alexin increases the productivity by 20-55% and provides high-quality, environmentally friendly products.

TO THE APPLICATION OF ZEOLITES FOR DETOXICATION OF CONTAMINATED SOILS

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The present paper is of survey character. On the basis of the analysis of some references the assumption is come out that zeolites both synthetic, and natural, and also zeolitecontaining materials, can be used for a detoxication and restoration of biological activity of the soils contaminated by inorganic (heavy metals) and organic (hydrocarbons) substances.

OUR PRIMARY SOURCES OF RENEWABLE ENERGY

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Nuclear and solar power are the primary energy sources over geological times for Earth and life's existence; and these remain humanities principal hopes for sustained energy sources. In near recent times an impending energy crisis looms for humans caused by our increasing global population coupled to our ever-growing industrial and technological appetites for energy. Today increased nuclear power use and the potential of nuclear fusion fission power are offered as energy hopes. But ,in reality, our sure principal renewable energy hope is to capture more sunlight. Restless humanity is remarkably innovative and creative. So before us we have the hope that mankind can make innovative energy provision steps that capture the unlimited energy from sunlight with "ecological clean types of solarsynthesis technologies" ; analogous to life shifting its dependence away from nuclear towards solar power billion of years ago.

FROM DISCOVERY UP TO INDUSTRIAL USAGE OF BIOGENIC ISOPRENE

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The course starting with discovery of isoprene at the institute of Botany of the National Academy of Sciences of Georgia in the middle of 50-s of last century up to the present day and importance of participating in this process of Georgian scientists and world scientific association is described. The most important aspects of this problem are discussed. Theoretical grounds of phenomenon of biosynthesis and excretion of isoprene by living organism, including photosynthesizing green cells, is shown – this is a widely spread natural phenomenon. Thus excretory function of plants was discovered. Thermodynamic model of living cell is discussed on this ground, on the basis of which is the necessity of presence of dissipative structures in cells, providing compulsory throwing of surplus energy in form of deS entropy. Attempts of practical application of biogenic isoprene in industry completed with using it for creation of synthetic rubber, prime cost of which is considerably lower than of that, produced from oil. Questions of subsequent studying of biochemical aspects of this phenomenon and possibility of their most affective usage in industrial biotechnology are discussed.

SOILS OFFER IMPORTANT LESSONS: A COMMENTARY

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There are limits to exponential growth when resources are fixed, as demonstrated by the collapse of some civilizations over time. Our world has been operating as though the Earth and its biotic and abiotic resources are a global commons with no one responsible for the future. What a fantasy! Soil Science as a member of National Academies of Science has a moral responsibility to use its knowledge and skills to assist in making our globe a meaningful and sustainable habitat for all inhabitants.

CHARLES DARWIN AND THE DISCOVERY OF BIOTURBATION IN THE YEAR 1837

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In the year 1837 the English scientist Charles Darwin already discovered bioturbation by earthworms as a soil forming process, where under an animal mould a layer of gravel was developed. The Swedish quaternary geologist H. von Post also described that many top horizons of soils are formed of coprogenic aggregates in 1862. The Danish forest soil scientist P.E. Müller discovered in 1879 that in loamy Luvisols under beech forest - influenced by earthworm bioturbation - mull developed as a form of humus. In contrast a humus layer developed on sandy Podzols because of a lack of earthworms. This was mor. In his famous book *Russian Chernozem* the Russian soil scientist V.V. Dokuchaev rejected 1883 bioturbation as a reason for the deep-founded humose Ah-horizons of the Chernozems. Later on, however, he realized the fact and considered besides vegetation also animals have to be an important factor in his soil-forming equation. Today bioturbation by earthworms, ants, termites, lugworms or termites, often supported by certain rodents and other insects, is considered to be an important soil-forming process. With bioturbation processes gravel and stones can be buried as stony layers in the subsoil. In contrast, with the processes of cryoturbation and peloturbation gravel and stones actively move to the soil surface.

THE ROLE OF TETRAPLOID SPECIES DIKA IN THE EVOLUTION OF THE WORLD SELECTION OF GENUS *TRITICUM L.*

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The paper shows the origin and spread of Dika and its role in evolution and world selection of wheat genus *Triticum L.* New data have been received using the inter-genus hybridization, especially of wheat dika main genus – var. *stramineum*, var. *rubiginosum*, var. *fuliginosum*. They are genetically different according to the plant height genes, and they are genetic source to receive immune, high yield and dwarf initial selective material. The hypothesis is suggested in addition to Piech and Evans hypothesis. It has been discovered that inheritance of dwarfness is both of alogogenic and poligogenic character. The paper gives the four locus model of dwarfness with two pairs of independent locus's.

PHOSPHORUS AVAILABILITY OF ROCK PHOSPHATE AND SINGLE SUPERPHOSPHATE AS RELATED TO SOIL STRUCTURE AND SOIL MOISTURE

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Phosphorus (P) availability does not only depend on concentration and diffusivity of P in soil but also on factors of root growth. Root morphology and root physiology are important parameters in P availability. The objectives of this study were to investigate the effects of coarse aggregate soil structure and soil moisture on the bioavailability of single super-phosphate and rock phosphate in pot experiments. Both coarse aggregate soil structure and soil dryness resulted in a strong decrease of root growth of summer wheat and summer barley. Grain yield decrease of summer wheat and summer barley was not so strong in soils fertilized with single superphosphate than with rock phosphate since the reduced root growth was compensated by a higher diffusivity of P from single superphosphate than from rock phosphate. Hence in arid climate zones soils with high clay content which are sensitive for problems in soil structure P should be applied as water soluble P fertilizer and not as rock phosphate.

ECOLOGICAL ASSESSMENT OF AZERBAIJAN SOILS FOR THEIR RATIONAL USE.

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According to tasks on planning of productivity of field cultures, on the basis of data of bonitation and other indicators, volumes of manufacture, the area of cultivation of forage crops and their efficiency can be defined. Results of soils bonitation are used at the decision of some practical problems: working out of perspective tasks on manufacture and purchases of production of manufacture and structure of areas under crops: distribution of mineral fertilizers fund: land management, on a regional lay-out, and the most important from an ecological position to a substantiation of system of nature protection actions.

ECOLOGICAL POTENTIAL OF PLANTS

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Elimination of contaminants from the environment by microorganisms of different taxonomic groups is a well established, genetically determined property, which has already been widely discussed. Until recently, plants, still occupying above 40% of the world land, were considered as organisms having only a limited potential for contaminants conjugation and accumulation within cell organelles. Analysis of experimental data of last two decades revealed the high ecological potential of plants. It has been exposed deep degradation processes proceeding in higher plants, in the majority of cases leading to the mineralization of contaminants. As a result the enzymes carrying out oxidation and conjugation processes have been revealed and characterised; formation of anthropogenic contaminants conjugates with endogenous compounds and enzymes participating in this process has been shown. Although, still there are in plants some unlearned steps closely related to the contaminants multistage degradation process, authors are making an attempts for the evaluation of different aspects of plants ecological potential from the modern understanding, revealing the criterion for the evaluation of deviations under the action of contaminants in ultrastructural architectonics of plant cells.

INFLUENCE OF HALIDE COUNTER IONS ON THE PHOTOCATALYTIC REMEDICATION OF RECALCITRANT CATIONIC SURFACTANTS

Hisao Hidaka and Teruo Horiuchi

A cationic surfactant is a recalcitrant and persistent substance in an aquatic environment. The remediation procedure by biodegradation or photocatalytic degradation for a cationic surfactant is commonly difficult. One reason is the depression of adsorption onto the positively charged TiO₂ surface in acidic or neutral solution. The effect of halide salts (bromide, chloride and fluoride) on the photocatalytic degradation of the different cationic surfactant structures were investigated. The cationic surfactants examined were benzyl dodecyl dimethyl ammonium halide (C12-BDAX), N-dodecyl pyridinium halide (C12-PX), N-hexadecyl pyridinium halide (C16-PX), dodecyl trimethyl ammonium halide (C12-TAX), and hexadecyl trimethyl ammonium halide (C16-TAX), where X stands for fluoride, chloride or bromide. The photoinduced degradation of these cationic surfactants was effected by the attack of strong oxidative OH radical species. The adsorption behaviors of the cationic surfactants onto the TiO₂ surface were estimated to be one of the rate-determining factors. The photocatalytic degradation was affected by the halide counter ion (fluoride ion, chloride ion and bromide) in the ammonium or pyridinium cationic surfactants. Aromatic ring disappearance determined by UV-spectral analysis, the mineralization by a total organic carbon assay (TOC loss) and the temporal change of surface tension were recorded against UV illumination time.

THE DRIVING FORCES OF SOIL FORMATION

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Four different forms of energy are involved in soil formation: gravity, orogenic energy, solar energy and anthropogenic energy. The specific influence of these forces is important for understanding soil development and functions under different physio-geographic and environmental conditions.

BOUND FORMS AND PLANT AVAILABILITY OF HEAVY METALS IN IRRIGATED, HIGHLY POLLUTED KASTANOZEMS IN THE MASHAVERA VALLEY, SE GEORGIA

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The fertile irrigated Kastanozem soils of the Mashavera valley, SE Georgia, have a high agricultural yield potential. The river water used for irrigation, however, is polluted with mining waste from a copper and gold mine situated in the mountainous region of the middle reaches of the Mashavera river. Furthermore, waste water from a floatation plant, erosion material from floatation waste deposits and acid mine drainage has led high concentrations of dissolved and suspended sulphidic heavy metals (HM) in the river water. Accordingly, most of the irrigated soils for agriculture display a strong enrichment of HM that can be traced back to irrigation with polluted water over a period of several decades. The concentrations of the total amounts of Cu, Zn and Cd increase with intensity of land use and the amount of irrigation in the sequence arable fields (highest), occasionally submerged meadows, vegetable gardens, wine gardens, and orchards with mixed cropping of vegetables. A high proportion of HM belongs to the supply fraction, unspecifically and specifically adsorbed HM dissolvable in ethylenediamine tetraacetic acid (EDTA). The narrow correlation of this fraction with the mobile and plant available fraction of HM indicates a high long-term risk potential within the food chain. Due to the recent high adsorption capacity of the soils for HM, only a small amount of HM in the mobile fraction was found. On the other hand, initial investigations of cereals and vegetable species indicate a high uptake of Cu, Zn and Cd, which for Cu and Cd causes concentrations in plants exceeding the safety thresholds for plants, animals and human beings. This was unexpected due to the weakly alkaline pH as well as the high contents of clay and organic matter of the soils. The narrow correlations between water-soluble metals in soil saturation extracts and the concentrations of decomposable organic matter (DOC) and SO₄ suggest that the mobilization of heavy metals occurs in micro-compartments of the well-structured topsoil. In phases of water saturation during irrigation, reducing conditions could favour a release of heavy metals from adsorption places at surfaces of Mn oxides. During drying of the topsoil, aeration leads to oxidation of sulphides and easily DOC. Acid conditions develop in the vicinity of plant roots and favour the mobility of HM, although the surrounding soil matrix has a small content of CaCO₃ and weakly alkaline pH. The results indicate the high actual risk of soil pollution from heavy metals into the food chain and the population.

REDUCTION OF TOPSOIL CONTAMINATION BY NANO AND AGRO TECHNOLOGIES IN CROP ROTATIONS

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The well known soil fertilizing system with mineral fertilizers as a ring of agro-technology, with another ring- plant protection by pesticides lead to the contamination of topsoil by ballast. With Conventional technologies, unfortunately, agricultural crops are using only about 30-50% of mineral fertilizers. As a result, farmers are obtaining ballast of chemicals, which are accumulated in the topsoil, and many centuries are needed for their absorption. For the reducing of contamination, the best way is an application of advanced (already patented) technologies when it's possible to cultivate crops with nano and agro technologies. Implementation of these technologies have been studied by our group of scientists during resent years. It was founded that proposed technologies have reduced expenditures on growing (53%) and soil contamination (253%). Ascertained the rules of technology for their application the contamination level were virtually determined for approximately 100 years of growing crops in rotation, with some legumes (lentil in this case) having an ability for biological nitrogen fixation.

AGROTECHNICS OF CULTIVATION, PLANTING AND PROTECTION OF BAMBOO SEEDINGS

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The following species of Bamboo spring vegetation are considered the most perspective in the subtropical regions: Japanese Madake – *Phyllostachys reticulata*, Chinese Madake – *Ph. Simonsoni*, Mosso – *Ph. Pubescens*, black Bamboo – *Ph.Nigra*, gold Bamboo – *Ph.Aurea*, green-blue – *Ph. Viridi glaucescens*, etc. The above enumerated Bamboo species multiply by: a) seedlings – transplanting large tree-saplings directly from the plantation; b) roots – i.e. by seedlings cultivated at nursery. While cultivating Bamboo on a small territory, planting is performed by the seedlings taken out directly from the plantations. However, in case of the great demand on seedlings it is preferable to create a plantation by the seedlings specially cultivated at nurseries by roots [1].

ECOLOGICAL CIVILIZATION: PLANNING, MANAGEMENT AND MONITORING

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The paper is dedicated to the new concept: ecological civilization (ecocivil) planning, management and monitoring as a goal of sustainable development. The principle elements of ecological civilization such as greening economy, formation of a new consumption patterns as well as new ecologized life style and behavior have been discussed.

INFLUENCE OF GEOMETRIC PARAMETERS ON DURABILITY OF OPERATING ELEMENTS IN SURFACE TILLAGE OF SOIL

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As criterion for assessment of durability, such admissible wear-out of the operating element of ripper has been selected, after which it becomes necessary to restore the operating state of its cutting rim. The obtained graphical/analytical dependencies characterize the influences of soil conditions and geometric peculiarities of the operating element on the value of wear-out of the cutting rim of the wedge.

INFLUENCE OF RIVER BED BOTTOM GRADIENT ON PARAMETRES OF WAVE MOTION FOR HYPERCONCENTRATED DEBRIS FLOW

O.G. Natishvili, V.I. Tevzadze

Calculation method of river bed bottom gradient influence on hydraulic characteristics of motion wave mode of Hyperconcentrated debris flow is stated. Received dependences confirm that influence of bottom gradient essentially changes a picture on wave motion for forward stream surfaces.

FOREST STANDS AROUND YEREVAN CITY AS ENVIRONMENT FOR THE FORMATION OF FOREST BIOTOPE BIRD FAUNA

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In the paper there are references concerning the study of vegetation and bird fauna during the afforestation process of Yerevan city surroundings, which is situated in semi-desert forest region of Armenia and is characterized by mountainous landscape and very continental climate. It has been stated that greening activities change the preliminary landscape and create favorable environment for the forest biotope bird fauna. Due to country's energetic crises in the 1990s the considerable part of forest stands around Yerevan city were cut down, which caused the infringement of vegetation cenosis, as well as decrease of the bird fauna ecologic group. In grass synusia, after logging, the xerophytization of vegetation associations is observed.

VALUATION OF MOUNTAIN FORESTS CASE STUDY ARMENIA

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In article are discussed the mountain forests valuation issues on the base of case study of Armenian forests and examples from the other countries. The several aspects of forest direct use, non wood forest products and indirect use values are discussed by giving particular attention to local conditions.

ECONOMIC AND LEGISLATIVE ASPECTS OF LEASING REGULATION

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The present paper is devoted to the discussion of economic and legislative issues of leasing process regulation. Particularly, it gives the explanation of the concept of leasing, the presentation of its contents, as well as definitions and strong accent on the primordial role of leasing in the country's development. The paper includes the description of the role of leasing for attracting investments, promoting and favoring business and banking system development. In addition to the above-mentioned, the paper also provides the analysis of the main economic clauses of different types of leasing contracts all by providing the relative economic comparison between leasing and crediting.

PRIORITIES FOR SUSTAINABLE DEVELOPMENT OF GEORGIAN HIGHLANDS

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Low agricultural productivity, land degradation and poverty are interrelated problems in the Georgian highlands. While the causes of such problems are well known, the underlying causes are complex, and depend upon many region-specific factors that vary greatly across the diverse circumstances of the highlands. In the article, we point that an appropriate strategy for sustainable development depends greatly upon the ways of development that are feasible in a given location. We argue that such development ways should be determined by factors strengthening comparative advantage of highlands: infrastructure, agricultural potential, access to markets, credit systems, school education level and population density.