

Questionnaire

Summary of the main activities of a scientific Organisation of the Slovak Academy of Sciences

Period: January 1, 2003 - December 31, 2006

I. Formal information on the assessed Organisation:

1. Legal name and address

Institute of Botany, Slovak Academy of Sciences
Dúbravská 14, 845 23 Bratislava

2. Executive body of the Organisation and its composition

Directoriat	name	age	years in the position
director	RNDr. Ivan Jarolímek, CSc.	52	1999-
deputy director	RNDr. Igor. Mistrík, CSc.	57	1999-
scientific secretary	RNDr. Milada Čiamporová, CSc.	62	1990

3. Head of the Scientific Board: RNDr. Pavel Lizoň, CSc.

4. Basic information about the research personnel

- i. Number of employees with a university degree (PhD students excluded) engaged in research and development and their full time equivalent work capacity (FTE) in 2003, 2004, 2005, 2006 and average number during the assessment period

	2003	2004	2005	2006	average
Number	48	54	53	59	53.5
FTE	45	48	47.25	51.1	47.84

ii. Organisation units/departments and their FTE employees with the university degree engaged in research and development

Research staff	2003		2004		2005		2006		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
organisation in whole	48	45	54	48	53	47,25	59	51,1	53,5	47,85
Department of Non-Vascular Plants	9	9	10	10	10	9,5	10	9,5	9,75	9,5
Department of Vascular Plant Taxonomy	13	11,5	16	11,5	14	12,75	15	15,12	14,5	12,718
Department of Geobotany	8	8	9	9	9	8,5	10	8,5	9	8,5
Department of Plant Physiology	18	16,5	19	17,5	17	16,5	19	18	18,25	17,125

5. Basic information on the funding

- i. Total salary budget¹ of the Organisation allocated from the institutional resources of the Slovak Academy of Sciences (SAS) in 2003, 2004, 2005, 2006, and average amount for the assessment period

Salary budget	2003	2004	2005	2006	average
total salary budget (millions of SKK)	16,292	16,542	16,821	17,789	16,861

6. URL of the Organisation's web site: www.ibot.sav.sk

II. General information on the research and development activity of the Organisation:

1. Mission Statement of the Organisation as presented in its Foundation Charter

1. Research activities of the Institute of Botany are oriented at basic research in systematic, experimental and environmental botany. The main capacity is concentrated on
- i/ Study of diversity and evolutionary relations of fungi, non-vascular and vascular plants and plant communities. The mission is to deepen and extend our knowledge on plant and fungi kingdoms, to understand the variability and evolution of individual taxonomic groups and plant communities and, consequently to solve taxonomic and nomenclature questions.
 - ii/ Experimental study of structure and functions of plant organisms at various organisation levels and their responses to abiotic and biotic factors of the environment. The mission is to disclose

¹ Sum of the brutto salaries without the fund contributions.

and elucidate causality of growth and developmental processes, and the mechanisms of their control.

2. The results of research activities (Research outputs) are published in scientific journals and books, presented in scientific conferences and incorporated into pedagogical process.
3. The Institute carries out doctoral study according to actual legislation.
4. The Institute provides consultant and expertise services related to its research activities.
5. The Institute builds up, maintains, and manages herbarium with the acronym "SAV", registered in the international Index Herbariorum, and collections of microorganisms (cyanobacteria, algae, and microfungi).

2. Summary of R&D activity pursued by the Organisation during the assessed period, from both national and international aspects and its incorporation in the European Research Area (max. 10 pages)

Research in the Department of Vascular Plant Taxonomy has been concentrated on the following activities:

(1) Inventory of the diversity of the ferns and flowering plants in Slovakia. Results of this research direction are reflected in the publication of the most recent volume of Flóra Slovenska (Flora of Slovakia), volume V/3, dealing with the taxa of the orders *Hamamelidales*, *Urticales*, *Fagales*, *Juglandales* and *Salicales*. Many of them represent native or introduced shrubs and trees, which are important for forestry. The next volume of Flóra Slovenska (Flora of Slovakia) VI/1, focused on the taxa of the orders *Cistales*, *Elatiniales*, *Begoniales*, *Tamaricales*, *Violales*, *Cucurbitales* and *Campanulales* is in press. The multivolume publication Flóra Slovenska (Flora of Slovakia) represents the first thorough inventory of the plant diversity in Slovakia, and serves as an important tool for biodiversity protection, forestry, agriculture, but also for all those who are concerned with plants in diverse branches of science. The publication is in Slovak, but all identification keys are available also in English. Distribution maps, synonyms and lists of localities provided are easy to understand also for those whose mother language is other than Slovak. The book is possessed by most of the major European botanical libraries.

While the Flora of Slovakia is a multivolume work and represents a long-term project elaborating all plant families occurring in Slovakia in detail, another ongoing work is the Identification key to the ferns and flowering plants of Slovakia. As a single volume it will allow identification of all plants growing in Slovakia, and thus will be an irreplaceable tool for all those who work with plants in the field, as well as for all levels of education. The work on the Key is in good progress, with publication expected in early 2008.

The third main project is a survey of chromosome number data related to the area of Slovakia. The first version of the on-line database entitled Chromosome numbers survey of the ferns and flowering plants of Slovakia has become available for general public at <http://147.213.100.121/webapp/>, and will be finalised and officially launched in the first half of 2007, together with the book and the CD ROM. The database, book and CD represent a complete inventory of the chromosome number reports on the ferns and flowering plants from Slovakia, subjected to a critical revision by experts. It is the first publication of this kind that will be available also on-line and will be continuously updated. The remaining two activities within the inventory of the plant diversity refer to the Database of the distribution of ferns and flowering plants of Slovakia, which is now being generated in the Institute of Botany, and the List of taxa originally described from the area of Slovakia. The List is supported by an extensive documentation compiled or copied from original literature sources, as well as by the photographs of the type specimens from the herbaria in Slovakia, Czech Republic and Hungary. Part of the material is already available on-line

at http://ibot.sav.sk/FaFpdfS/type_specimen_SAV.html. Its role is important for the study of taxa originally described from the area of Slovakia, for which our country has an ultimate responsibility also in terms of the Convention on Biological Diversity.

(2) Participation in the European and global scale biodiversity projects. Institute of Botany and namely the Department of the Vascular Plant Taxonomy had been providing data to the large European collaborative project Atlas Florae Europaeae since its first volumes. During the assessed period we have provided distribution data on 103 species of the family *Rosaceae* to the Volume 12 of this Atlas, and also data on more than one hundred species of the genera *Alchemilla* and *Aphanes* for the Volume 13, which is currently in press. The Institute actively took part in projects of the 5th and 6th Framework Programme dealing with biodiversity issues: Euro+Med PlantBase (establishing the structure of the complex information system of the ferns and flowering plants in Europe), BioCASE (providing the information system on the biodiversity collections in Europe), ENBI (European Network for Biodiversity Information, representing the EU contribution to the Global Biodiversity Information Facility), ENSCONET (European seed conservation network), and IntraBioDiv (evaluating floristic and genetic diversity of the subalpine and alpine belts of the Alps and Carpathians as model areas for the study of mountain plant diversity). These projects contributed to the establishment of several on-line services, which are likely to play considerable roles in future biodiversity studies in Europe, but also outside the continent. Within the project IntraBioDiv a unique dataset on floristic and genetic diversity was completed and this will be published in numerous publications, which will appear in 2007 and early 2008. The role of the Institute among the European taxonomical institutions is expressed also in the participation in the EU Network of Excellence EDIT, building a virtual European Taxonomical Institute. Last, but not least the Institute hosts the national focal point of the Global Taxonomy Initiative and the Global Biodiversity Information Facility.

(3) Basic research on taxonomy and phylogeny of selected groups of flowering plants on the Carpathian and Pannonian, European, and in some cases also worldwide scale. Numerous taxonomic studies have been carried out in selected genera and species groups, mainly in the genera *Cardamine* and *Arabidopsis* of the *Brassicaceae* family, the genera *Hieracium*, *Pilosella*, and *Senecio* of the *Compositae* family, as well as in some other flowering plant groups. These studies have successfully combined thorough work in the field, evaluation of morphological variation using methods of multivariate morphometrics, karyological studies using direct chromosome counting and flow cytometry, as well as methods of molecular systematics (AFLP analyses, chloroplast DNA and nuclear DNA sequences). These studies are relevant not only for better understanding of the taxonomy and evolution of particular species group or genera, but are also highly relevant for getting deeper insight into plant evolution, phenomena of polyploidy, hybridisation, as well as for addressing phylogeographic questions that aim to reveal postglacial history of European vegetation. Broader relevance of such research papers is expressed also in their citations well beyond the studies of the respective genera. Giving a few examples, interesting patterns of cytological variation was found for instance in the *Compositae* species *Senecio jacobaea*. Both tetraploids ($2n = 4x = 40$) and octoploids ($2n = 8x = 80$) were found in the Carpathians and Pannonia, while in the other parts of Europe the species nearly lacks karyological variation. The Carpathian and Pannonian material may help to understand the evolution of this species throughout the European continent. The Carpathians harbour high genetic and taxonomic diversity worth to explore, as it can be exemplified by the genus *Arabidopsis*. Substantial genetic, morphological and karyological variation has been found here, offering a unique opportunity to extent our knowledge accomplished with the model species *Arabidopsis thaliana* to its close relatives, and to explore a number of scientific questions in a comparative context. An interesting example is also our study on the origin and evolutionary history of *Cardamine asarifolia*

(Brassicaceae), a hexaploid endemic plant of the South-West Alps and their foothills. The use of the most advanced methods of molecular systematics (a nuclear single-copy gene) in combination with morphometric, karyological and palynological data helped to explain the incongruence of the information gathered from cpDNA and nrDNA sequences, and to infer parentage of this preglacial hexaploid taxon. The study was published in the prestigious journal *Molecular Phylogenetics and Evolution*. Another study, recently published in *American Journal of Botany*, shed light on the evolutionary relationships of European, Eastern Asian and North American plants classified as *Cardamine flexuosa*. The study clearly showed that the European tetraploid *Cardamine flexuosa*, known generally as a forest plant, is of different evolutionary origin from the Eastern Asian octoploid, which has to be classified as a different species. Both taxa occur as introduced in the North America. The importance of this study is underlined by the fact that the Eastern Asian taxon is a notorious weed of rice fields in Japan and China and therefore of economical importance. Surprisingly, it was found very recently as introduced also at two localities in Europe, the fact to which proper attention should be paid. The results of the long-term studies on the genus *Cardamine* led to its acceptance as a model genus for the wide array of studies planned by the Brassicaceae Phylogeny Working Group, in which Brassicaceae students from all over the world aim to unravel evolutionary history of this economically very important family.

The researchers of the **Department of Non-Vascular Plants** discovered and provided unique knowledge on species richness, taxonomy, variability, ecology, and chorology of algae, cyanobacteria, lichenized and non-lichenized fungi and bryophytes.

(1) Diversity of non-vascular plants in Slovakia. Current research of selected regions of Slovakia as well as of other European countries brought new original knowledge on diversity of non-vascular plants.

Rivers: Diversity of phytoplankton of several rivers was studied. More than 1,100 species of cyanobacteria and algae have been recorded for the Danube River and its main tributaries in Slovakia. The collected phycological material has been used in two monographs *Atlas of Euglenophytes*, and *Chlorococcal Algae (Chlorophyceae)*. During our investigations of phytoplankton of the Morava River, 634 species were determined, belonging to 25 genera of cyanobacteria and 181 genera of different groups of algae. From the Dyje River altogether 346 species of cyanobacteria and algae were determined. Qualitative and quantitative data on phytoplankton from the upper, middle and lower stretches, and from the lowermost Dyje River were obtained. The study of thermophilic phototrophic microorganisms in thermal waters at Piešťany showed the present of 20 infrageneric taxa of cyanobacteria and 217 taxa of algae, while at Sklené Teplice it was 30 species of cyanobacteria and 83 taxa of diatoms (Bacillariophyceae).

The Tatry Mts.: Complex study of diversity of lichens and phytopathogenic fungi and their host plants was carried out in the International Biosphere Reserve Tatry National Park. The knowledge on the occurrence of lichens on the Slovak and Polish territory of this region was published in monograph "The lichens of Tatry Mountains". 1309 lichen taxa and 80 taxa of lichenicolous fungi were recorded here, incl. high number (326 species) of epiphytes. Historical knowledge and new information on distribution of 310 taxa and 21 infraspecific taxa of phytopathogenic fungi were recorded. The first list of fungi, their hosts, and an actual state of diversity were prepared and the first list of species and bibliography of Taphrinomycetes and their host plants referring to the reserve was published.

Further large scale protected areas of Slovakia: new entries on lichens of the Veľká Fatra Mts. (altogether 380 taxa), Strážovské vrchy Mts. (350 taxa), Kysucká vrchovina Mts. (156 taxa), Zoborské vrchy Mts. (169 taxa) were collected; an analysis of lichen diversity of eight primeval forests (e. g. National Nature Reserve Dobročský prales – 62 taxa) in Slovakia was completed. Bryoflora of NNR Dobročský prales, comprising 61 taxa of bryophytes was evaluated too. The

endangered and rare species *Buxbaumia viridis* and *Neckera pennata* are the most valuable records. Investigation of bryophytes of Podunajská nížina lowlands and Hronská pahorkatina hills showed that the bryophyte diversity is richer in salt meadows than on inland dunes. The salt meadows are significant for rare, halophytic bryophyte species (e. g. *Enthosodon hungaricus*).

Taxa new for the investigated areas: In thermal waters seven taxa of diatoms (i. e. *Gomphonema insigne*, *Navicula subglucida*, *Nitzschia desertorum*, *Surirella terricola*) and eight species of Cyanobacteria (i. e. *Cyanobium parvum*, *Geitlerinema thermale*, *Scytonema stuposum*) are new records for algal flora of Slovakia. In the Tatry Mts., 25 new species of phytopathogenic fungi (e. g. *Microbotryum pinquiculae*, *Protomyces crepidis-paludosae*) and 26 species of lichens (e. g. *Absoconditella celata*, *Protoparmelia montagnei*, *Usnea wasmuthii*) were recorded. *Gymnopilus fulgens* and *Bovista paludosa* (endangered species of fungi) were reported on new sites in the Laborecká vrchovina Mts.

Taxa new for Slovakia: Data on the occurrence of several species, which had not been known from Slovakia so far were found, e. g. *Pseudobaeospora celluloderma* (macromycetes), 55 lichen species (e. g. *Lecanora ramulicola*, *L. schwartzii* subsp. *nylanderi*, *Dimerella lutea*, *Xanthoparmelia tinctina*, *X. angustipholia*). On the contrary, the revision excluded the occurrence of *Xanthoparmelia verrucigera* in Slovakia.

(2) Non-vascular plant diversity of Europe. Extensive synthesis of lichen diversity of the Western and Eastern Carpathians was prepared by the lichenologists of the Institute of Botany as members of international team through two books – monographs: “A Catalogue of Eastern Carpathian Lichens” and “Checklist of the Western Carpathian Lichens”. In total, on the territory of the Eastern Carpathians (in Poland, Slovakia, Ukraine, Romania), 1304 taxa of lichenized and lichenicolous fungi were registered, accompanied by 355 relevant bibliographic entries. From the territory of the Western Carpathians (in Austria, the Czech Republic, Slovakia, Hungary, and Poland), a total of 1815 taxa of lichens and 1245 bibliographic entries were collected. The third book: “Central European Lichens - Diversity and Threat” is dedicated to Dr. Ivan Pišút, founder of the Slovak lichenological school. The monographs demonstrate the presence of lichens in individual regions of the Carpathians and significantly contribute to the knowledge of total biodiversity of the European continent. At the same time they point at the unbalanced level of recent knowledge on lichenized fungi in one of the most important mountain range in Europe, the Carpathians.

The first records of invasive phytopathogenic species in the Carpathians were recorded (e. g. *Melampsorium hiratsukanum*, *Erysiphe azalea*, *Phyllactinia corni*) and the taxonomical knowledge on rare species of fungi and their hosts in European area (e. g. *Vankya vaillantii*, *Protomyces cirsii oleracei*, *Erysiphe azalea*, *Septoria mori*) was extended. Two taxa of fungi formerly not known from arctic areas were discovered within material from Greenland: *Russula clavipes* and *R. cicatricata* (macromycetes).

Occurrence of the suboceanic species *Xanthoparmelia mougeotii* was confirmed on one of the easternmost fringes of its European distribution area. For the first time, the rare species *X. felkaensis* was recorded in Austria and Russia. The records of further two lichens new to Hungary and four lichens new to the Czech Republic were published.

Comparative studies of cyanophytes and algae in Danube River showed that the water quality of the German-Austrian-Slovak parts of the river is generally good, mesotrophic, whereas the Hungarian part is eutrophic. Investigations of the Morava River since the late 1950s show that water quality has been increased, nevertheless the river has still eutrophic status.

(3) Taxonomy of non-vascular plants. A complex study of taxonomy of model fungal genera (incl. lichens) brought new knowledge on systematic position of several critical taxa. Recent taxonomical treatment and nomenclature of fungi described from Slovakia by Kalchbrenner were accomplished and list of accepted names was prepared. The most important taxonomical novelties are: neotype of

Rhodocollybia fodiens is replaced by lectotype and a material collected on type locality is designated as epitype; four taxa of the genus *Pholiota* and three taxa of the genus *Hygrophorus* are typified by illustrations from original publication, and/or by material collected in the area of type localities. The delimitation of four accepted species related to *Russula xerampelina* was revised and new characters were established for its determination. Our revision resulted in the following conclusions: *R. pascua* – a correct name, *R. nuoljae* – a dubious name, *R. chamitae* – a synonym of *R. subrubens*. Analysis of nuclear and mitochondrial sequences (ITS, LSU rRNA, mtDNA) of the aggregate *Leptogium schaderi* showed potential separation of the thalli from the *L. plicatile* group. The status of *Solenopsora carpatica* was clarified, regarding its relations to the closely related species *S. candicans* and *S. cesatii* using analysis of all known populations of the species from the Western Carpathians and the Alps. The results of morphometric and chemical analyses confirmed delimitation of all the three taxa as separate entities and did not support synonymisation of the species *S. carpatica* with *S. cesatii*.

New knowledge for science: Important scientific result is the description of the taxa new for science: *Pseudobaeospora basii* Adamčík & Ripková (macromycetes), *Pseudocercospora tatrensis* Mulenka & Bacigálová (micromycetes) and new combination *Nectriopsis tatrensis* (Alstrup) Lisická & Alstrup (lichens). The life cycle of a rare nostocalean species *Chlorogloeopsis fritschii* was studied in cultures isolated from localities in India (type locality), Slovakia and Tunisia. As in the genera *Nostoc*, *Trichormus* or *Nodularia*, in *C. fritschii* all vegetative cells were able to transform into akinetes. The akinetes divided asymmetrically into a smaller part to be transformed into a heterocyte, and a bigger one, which divided again into two equal parts as vegetative cells, what is unique in this group of cyanobacteria.

Research in the Department of Geobotany has been concentrated on the following activities: (1) Inventory of the vegetation diversity in Slovakia continued at both regional and national levels. The most important results at the national level were included into the newest book of multivolume monograph “Vegetation of Slovakia 4. High mountain vegetation”, which was submitted for printing in 2006. This volume comprises high-mountain plant communities of tall-herb meadows (*Mulgedio-Aconitetea*) and communities of subalpine shrubs at banks of rivers (*Betulo carpaticae-Alnetea viridis*), montane and alpine calcareous stepped and garland grasslands (*Elyno-Seslerietea* and *Carici rupestris-Kobresietea bellardii*), snow beds chionophilous communities (*Salicetea herbaceae*), arctic-boreal dwarf-shrub heathlands (*Loiseleurio-Vaccinietea*) as well as alpine acidophilous grasslands (*Caricetea curvulae*), each comprehensively elaborated in this book. The volume is closed by the characteristics of high-mountain mat-grass swards of the alliance *Nardion strictae*, although other communities of the class *Nardetea strictae* will be included into next volume dedicated to meadows and pastures vegetation. This vegetation survey has resulted from the work of many experts in various types of high-mountain vegetation in Slovakia and summarises results of their long-time research in the field. This survey reflects the current status of our knowledge on floristic composition and distribution of high-mountain and alpine non-forest communities in Slovakia and presents current opinions on their syntaxonomical status. The book will be useful contribution for phytosociologists, as well students, nature conservationists, all those working in inventory and management of endangered habitats, plant communities and plant taxa, and last but not least to those making legislature and executive decisions on land use and nature management at all levels of regional and national government. Synoptic phytocoenological tables and extended English summaries enable using this book abroad. These integral parts in the previous volumes resulted in high citation response. European initiative “European vegetation Survey” within the International Association of Vegetation Scientists (IAVS) methodically supported publication of similar surveys in Austria, United Kingdom, the Netherlands, Hungary and recently also in the Czech Republic.

Special attention at regional level was paid to Borská nížina Lowland (synanthropic vegetation), Krivánska Malá Fatra Mts. (subalpine vegetation), Muránska planina Mts. (complete spectrum of

non-forest vegetation), and Poľana (penetrating of trees into abandoned pastures and forest structure development). Original and new knowledge on vegetation cover of these regions was published in numerous scientific papers. These data represent an irreplaceable information source for projects in national and European scale.

(2) Results of the European or broader scale biodiversity projects. The Institute of Botany, namely Department of Geobotany, Department of Vascular Plant Taxonomy and Department of Non-Vascular plants closely cooperated in project Natura 2000 in Slovakia: Bridging the implementation Process. As a member of EU, Slovakia is obliged to adjust its nature protection practices and legislation to the EU requirements as expressed in the Habitats Directive (92/43), and Bird Directive (79/409). The project focused on building of information, data and methodological background for Slovak organizations responsible for implementation of European Directives in Slovakia (Ministry of Environment, State Nature Conservancy). Its aim was to bridge the current gaps in transition phase of the implementation process. The project helped to prepare a proposal of network of protected areas of European importance (Natura 2000 network) in Slovakia. The database of information on flora and vegetation in the areas included into the Natura 2000 network in Slovakia was considerably regenerated and supplemented. This was essential for exact evaluation of their actual status and for comparable standard for evaluation of their development and changes in the future. Most important information was summarised in books Biotopy európskeho významu na Slovensku [Habitats of European Importance in Slovakia] and Priaznivý stav biotopov a druhov európskeho významu [Favourable conservation status of habitats and species of European interest]. The favourable conservation status of all habitats and organisms included into the European Directives was defined and the methodology of its evaluation and classification was prepared. Management recommendations for securing or improvement of the favourable conservation status of all relevant habitats and organisms were proposed. The methodology of monitoring of habitats and species was prepared including concept of data collecting, storage and analysis. The Institute of Botany participates proportionally in all goals of the project dealing with flora and non-forest vegetation. Importantly, rich information sources, built up for a long time in the Institute in connection with our work on the monograph series *Flora of Slovakia* and *Vegetation of Slovakia*, were in this way utilised for the nature conservancy in Slovakia.

Numerous results were obtained by investigating the relations between aquatic plants and habitats and their environmental conditions within the common project of all Danube countries MIDCC (Macrophyte Inventory Danube Corridor and Catchments, www.midcc.at). Identical methods used in the field and the consequent common data analyses give the opportunity to compare environmental situation in Central and Eastern Europe (nine countries) and to adopt the current requirement - to evaluate the potential of aquatic macrophytes as biological indicators of the environmental conditions of rivers according the Water Framework Directive (Council of the European Communities, 2000).

Vegetation diversity of forests in the Northern part of Korean Peninsula was evaluated by numerical syntaxonomic methods and compared with relevant types of vegetation in surrounding countries. In close cooperation of Czech, Slovak, Russian (Siberian), Chinese, South Korean, Japanese and North American experts the monograph on Forest Vegetation of Northeast Asia was published. Several vegetation units at the level of alliance, association and subassociation were described as new for science.

Research in the Department of Plant Physiology concentrates on the following activities:

(1) In the field of stress physiology our efforts have been focused on the characterisation of aluminium and cadmium impact on structure and metabolism of barley roots. Cd, as well as Al are "non-essential" metals that already at low concentration inhibit plant development and cause important structural and functional changes in plants. They are easily taken up and accumulated in

plant roots inducing root growth inhibition and loss of cell viability. Initially, Al and also Cd ions are accumulated in root epidermal and outer cortical cell layers, later they are localized also in the cells of central cylinder. Exposure of roots to Cd or Al induces accumulation of callose and lignin deposits in the cell walls and speeds up differentiation of endodermis and xylogenesis closer to root apex. In Cd-treated roots the root hair formation was also shifted onward to 2-4 mm behind the root tip. Conversely, Al-treated roots showed reduced root hair formation, inhibition of initiation and growth of lateral root primordia and reduction of root cap length. Among the visible symptoms of Al toxicity thickening of 5 mm long proximal part of roots was typical for Al-treated roots. Root thickening was caused by both radial expansion of inner cortical cells in the transition zone of root and reduction of their elongation. At biochemical level the Cd-induced premature xylogenesis, and the Al-induced inhibition of root cell elongation were demonstrated as a consequence of Cd- and Al-induced H₂O₂ burst, and of elevated peroxidase activity in the root tip. Enzymes responsible for the high H₂O₂ production in root apices treated with Cd and Al were NADH-oxidase, oxalate oxidase and some non-specific peroxidases. In situ analyses showed that both elevated H₂O₂ and peroxidase activity localized in root apex are involved in Cd- and Al-stimulated premature development which correlated with shortening of root elongation zone and thus with the root growth reduction. Simultaneously the elevated H₂O₂ and production of reactive oxygen species during Cd or Al treatment participate in oxidative damage of the root cells plasma membrane, resulting in changes of membrane potential differences, ion uptake, loss of cell viability and cell death.

(2) Metabolic and anatomical responses of the plants to water deficit. The absence of water is a critical point in the growth and plant productivity. If we want to increase productivity of economically important crops we need to understand the mechanisms of defence against and adaptation to the drought. As we had found some changes in the levels of soluble sugar and starch in maize roots and leaves during the drought, we studied the synthesis of osmotically active substances such as proline together with activity of some enzymes of sugar metabolism. The other task was to determine the induction of alternative oxidase and to study respiration parameters in root cell mitochondria and, together with the appearance of antioxidants (ascorbate), the activities and PAGE patterns of antioxidant enzymes such as superoxid dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX) and guajakol peroxidase (GPOX) to find in various plant organs (root, mesocotyl, leaves) some pattern of the defence system against the oxidative damage caused by water deficit.

The most important results showed that under osmotically-induced water stress (a) The total respiration rate decreased as a result of reduction of the capacity and activity of both cytochrome and alternative metabolic pathways. The importance of alternative pathway in these conditions markedly increased. (b) The proline accumulation increased in all organs: in a sensitive cultivar is almost two times as high as in a tolerant one. (c) Within the spectrum of soluble proteins accumulation of 52.5kDa, 53.7 kDa and 55 kDa proteins decreased in the 1. leaf of both cultivars. (d) Mesocotyl seems to be an organ which responds very well in all the studied parameters and we think it necessitates more attention in further studies. (e) The scavenging of H₂O₂ was mediated mainly by the CAT in the roots while it was mediated by the APX and GPOX activities in the leaves in both cultivars. (f) The SOD activity increase in all organs of both cultivars and was dependent on the age of the stressed plants, being higher in the seedlings.

(3) Contribution to the life strategy of the species *Colchicum autumnale*. Research on the life strategy of *Colchicum autumnale* was completed. For the first time the structural, biochemical and physiological aspects of the developmental cycle of this species have been published. Besides the morphological characteristics, the dynamics of biosynthesis and degradation of the storage proteins, starch and cell wall polysaccharides as well as polyphenols and colchicinoid biosynthesis have been evaluated. The starch was found to be the main storage material (50% of d.m.) while proteins

represented 12% of d.m. The developmental profiles, properties and localisation of the key enzymes, which significantly affect the formation (ADP-glucose pyrophosphorylase, sucrose synthase, polyphenol oxidase, nitrate reductase) and utilisation (α -amylase, α - and β -glucosidase, invertase, exo- and endopeptidases) of both, storage and transient stored material in the mother corm and in the leaves were determined during the individual developmental stages of life cycle. The structural analysis at the tissue and subcellular levels allowed us to characterise the specific features of the hysteroanthous geophytic life form (the presence of 4 generations side by side within the annual life cycle; a strict control of the formation, maturation and degradation of the amyloplasts in mother and daughter corms; abscission zone and programmed senescence of the above-ground part of plant). In relation to the potential of *C. autumnale* to produce colchicinoide alkaloids, we isolated, identified and quantified basic and neutral colchicinoides. The production of these inherent secondary metabolites is strictly tissue-specific and reflects its coupling with the sequence of the main transitions of the life cycle. *C. autumnale* appeared to be the advisable model for studying the individual transition sequence within the bioprogram of hysteroanthous geophytes, about which only limited information exist till now.

(4) Participation of endomembranes and components of cell wall in the maintenance of plant cell polarity. The most important results were achieved from the microscopy of living cells in control and modified plants with structural and developmental aberration of root hairs. Integrated approach consisted of modern methods of confocal microscopy, videomicroscopy and evanescent wave microscopy. By their combination dynamic processes of growing plant cells were addressed in a complex way. One application of such non-invasive study of living root cells in high resolution was the aluminium toxicity in *Arabidopsis thaliana*. Aluminium interfered with root growth, induced changes in membrane potentials of sensitive cells and altered the production of signal molecules. We documented the process of aluminium internalisation in a defined zone of *Arabidopsis* root. This allowed us to formulate a hypothesis that this process may be part of its detoxification within the mechanism of plant growth recovery.

In growing root hairs we characterized the cytoarchitecture in their tip, targeted vesicle transport, organelle movement, membrane recycling as well as dynamic behaviour of endosomes. We confirmed rapid endocytosis in growing root hairs and a tip-localized distribution of endosomes. Their role in endocytosis was evidenced using membrane-specific labelling. We proposed structural and functional composition of vesicles in the tip zone of the root hairs. Results clearly show that the active endocytosis is localized in the tip of root hairs, it is actin cytoskeleton-dependent, and does not rely on endoplasmic reticulum.

We analysed the role of structural sterols in the maintenance of root hair polarity and their involvement in root hair tip growth in *Arabidopsis*. They are abundant in the plasma membrane of root cells, trichoblasts, and root hairs in different stages of their growth. We found that structural sterols represent a valuable marker in the process of bulge formation. During the root hair tip-growth the structural sterols are enriched in the tip and accumulate within endosomes. We participated in generation of transgenic seedlings of *Arabidopsis* and transgenic roots of *Medicago* expressing the internal marker for endosomes. *In vivo* analysis of root hairs in these systems revealed that endosomes accumulate within bulges of initiating root hairs as well as at apices of tip-growing root hairs. We studied the structure and dynamics of actin cytoskeleton in the tip growth of root hairs using transgenic constructs.

Process of cell differentiation in root epidermis of *Medicago sativa* has been characterized at cellular and ultrastructural levels. The role of cytoskeleton in cell morphogenesis was addressed particularly at the stage of bulge formation. Onset of bulge initiation was independent of cell size and distance from the root tip. We found cytochemical evidence that structural polysaccharides at the bulge are internalized from the cell wall to the cytoplasm. It may represent an indispensable step in the process of bulge formation, important for local cell wall thinning and turgor pressure

generation. These two factors mediate installation of tip growth in future root hairs. Other structural components of the cell wall, pectins were characterized in details in root meristematic cells. Pectins normally present in the cell wall are internalized into dividing cells of root apical meristem. We found them in endosomes close to the cell plate during cytokinesis. Finally also forming cell plate that is still not in contact with parental cell wall possesses cell wall pectins. Because endosomes receive pectins from the cell wall during endocytotic internalisation of cell surface material, this is the first evidence on participation of endocytosis in cytokinetic division of plant cells.

Another kind of endocytosis, the „fluid-phase“ has been documented in root cells of *Zea mays*. Evidences come from internalisation of „specific marker in the inner cortex cells within the transition zone of maize root. Internalization progressed through tubulo-vesicular compartments connected to plasma membrane close to plasmodesmata. This process is based on the interaction with actin cytoskeleton.

3. Concept of R&D activity of the Organisation for the next four years (max. 5 pages)

i. Present state of knowledge and status of ongoing research related to the subject of the Concept, from both international and national perspective

Floras, vegetation surveys, identification keys, and checklists should be recognised as information sources that have a central position in any taxonomic research and are of crucial importance for related fields (biodiversity conservation, forestry, agriculture...). To overcome the so-called „taxonomic impediment“, i.e. the fact that the lack of taxonomic knowledge prevents effective conservation of biodiversity, is one of the main goals of the Convention of Biological Diversity as expressed in all its basic documents and decisions by the signatory countries. The publication strategies are currently being changed towards the joint publication of the content both in a printed form and on-line. This gives the possibility of regular updating the information, which should reflect current knowledge and data obtained from the most recent studies. Indeed, the methodological and conceptual advance in plant systematics has been enormous in recent years and it is highly desirable to reflect it also in floras, keys and checklists and to spread among potential recipients as quickly and efficiently as possible. The idea of the free and full on-line access to the biodiversity information promoted by the Global Biodiversity Facility on the world scale brings new dimensions to the biodiversity research, and the world of biodiversity science is quickly changing in this respect.

Since 1990s, application of new, mainly DNA-based, methods has significantly changed plant systematic and taxonomic studies; currently, sophisticated methods and specialized equipment are usually required, and multi-methodological approach is preferred. Quick development of new methodological approaches requires more efficient cooperation among institutions and research groups, joint use of research facilities and exchange of know-how among research teams in different institutions. The networks funded within the EU projects and other international initiatives aim to support this approach. In spite of the methodological developments in systematics and taxonomy, combination of the thorough field work, extensive karyological and morphometric studies with the application of recently developed methods of molecular systematics is still not so widespread, and results of such extensive studies are relatively easy to publish in prestigious journals. There is a good chance for those who have a strong classical taxonomic background and are willing to learn and adopt the most advanced molecular systematic tools. Considerable advancement can be seen also in the area of karyology and studies of polyploids. The applications of flow cytometry are becoming more and more widespread, giving the possibility to screen a vast amount of plant individuals and to reveal hidden karyological variation within populations. This sometimes results in completely different views on microevolutionary processes in populations, on

the processes of the formation of polyploids, extent of their hybridisation and gene flow among different ploidy levels, than it had been expected before. Combination of flow cytometric data with molecular methods also opens new possibilities in the study of the phenomenon of polyploidy. The importance of such studies for basic as well as applied science is underlined by the fact that a vast amount of cultivated crops belong to polyploids, and polyploidisation has played a key role in their evolution.

Only a limited number of experts in Slovakia and world study the biodiversity of cryptogams and thus a great amount of scientific problems remain unexplained. The researchers of the Department of Non-Vascular Plants being the only specialized working team in Slovakia, discover and provide unique knowledge on species richness, taxonomy, variability, ecology, and chorology of algae, cyanobacteria, lichenized and non-lichenized fungi and bryophytes in Slovakia. Substantial part of these data has been incorporated in recently published checklists. The concept for future research is based on the knowledge of diversity of non-vascular plants as a starting point for consequent specific (e.g. taxonomic, ecological) research.

The current research concept addresses above all need for identifying the components of biological diversity in the Carpathian region, clarifying so far inadequate knowledge on selected taxonomic groups and detecting changes in diversity of cryptogams. This requirement has long been recognised and is explicitly included, amongst other places, in the Convention of Biological Diversity (CBD), in which the EU and all its Member States are included, in the EU Biodiversity Strategy as well as in regional conventions, e.g. the Carpathian Convention. One of the key points for the rationale is the rapid decline in biodiversity (addressed in Art. 7 of the CBD). The signatories are now required to identify components of biological diversity important for long-term conservation and sustainable use of biodiversity.

Phytocoenology was born and developed in Europe during 20th century as a tool for knowledge and classification of vegetation cover. From Europe it was spread into many parts of the world (Asia including Japan, South Africa, South America), but its developing centre remains in Europe. Outstanding database for storage of phytocoenological relevés (TURBOWIN) facilitates exchange of data, new statistical programs and utilities (SYN-TAX 2000, COCTAIL, JUICE) allow processing and evaluation of large sets of phytocoenological data using new specialised statistical approaches. In the field of geobotany, the main topics were substantially changed in the last decades, from regional syntaxonomical studies into large-scale (national or continental) syntaxonomical studies. International cooperation, exchange of data and using large datasets of phytocoenological relevés are a matter of course. However, recent vegetation science is oriented not only to syntaxonomy, but also to dynamic processes in vegetation, changes in vegetation cover as a consequence of global environmental changes and/or human impact, and mapping and modelling of vegetation using GIS-methods. Permanent challenge for frontier phytocoenological research is the application of results in the field of nature conservancy, e.g. in building of Natura 2000 network in Europe (great deal of all terrestrial habitats included into the European Habitat Directive is defined by typical vegetation units), or Carpathian Convention. The Department of Geobotany has direct contacts with European phytocoenological leaders and leading institutions and carries out activities in all the mentioned topics.

Research in the field of abiotic stress is important because of its impact on productivity and quality of agricultural products. The Institute of Botany has started with this topic at early 70s in the last century and during almost 30 years of research in this field, substantial changes have occurred in the methodology especially in incorporation of modern methods and techniques of molecular biology and genetics. Research of physiological processes has been directed to areas of cellular mechanisms involved in perception and transduction of stress-induced signals and proteomic and genomic changes in response to different stress factors. This area, especially the early stress-induced responses at the level of gene expression and molecular and cellular mechanisms involved in tolerance or increased resistance to toxic metals, drought and salinity are the main goals for the

future study. Social benefits of our studies might be the broadening of knowledge on the mechanisms responsible for tolerance or resistance of plants against stress factors and toxic xenobiotics. Economic benefits are connected with exploitation of these mechanisms in agricultural practice for production of new plants with improved tolerance to stress conditions which will be able to bring ample and healthy agricultural products even in environmentally contaminated soils. Results published in international journals and good cooperation with foreign institutions concerned with similar topics as the Department of Physiology have resulted in successful competitions for national and international research grants.

Generally, the strategy adopted by plants aims at avoiding the accumulation of excess of toxic metals in the cytosol, and thus preventing the onset of toxicity symptoms. This is achieved by the use of various mechanisms that are present and likely to be employed in general metal homeostasis in all plants. It appears feasible that specific mechanisms are employed for specific metals in particular species. These include mechanism to reduce uptake into the cytosol (entrapment in mucilage or in the apoplast) chelation of metals in cytosol or their efflux either to apoplast or into the vacuole. The ultimate goal of the research will be the generation of crop species with high resistance to toxic metals that farmers can use to cultivate in polluted soils throughout the world. Understanding the means of manipulating metal tolerance could be also important for development of crops for phytoremediation purposes, particularly for highly contaminated soils.

The fundamental questions concerning regulation of plant cell growth remain still open. Tip growth as a highly polarized type of cellular elongation is widely studied at developmental, cell biological and genetic levels. To explore tip growth regulation, tracing of vesicle motion is essential. Live cell imaging using advanced methods of microscopy like video-microscopy and enhanced-contrast microscopy enables monitoring of single vesicles and other intracellular compartments that had been known only from high-resolution electron microscopy. Within our international collaboration we are able to visualize small vesicles, their dynamic behaviour and also their contacts with the plasma membrane with the aid of fluorescence microscopy. This approach enables us to localize heavy metals at subcellular level and thus, to trace the distribution of heavy metals in living cells.

ii. Organisation's role or significance in the overall research effort within the field of the Concept on both the national and international scales

The Institute of Botany is a leading research institution in the study of taxonomy, phylogeny and diversity of plants and structure, syntaxonomy and ecology of plant communities in Slovakia. A high rank of international acceptance has the Institute attained in plant physiology. The Institute significantly contributes to biodiversity studies in the Carpathian and Pannonian areas, as well as in Europe as a whole, and is represented in major European and global projects and initiatives (they are summarised in part III-3 and III-4 of the Questionnaire). Its research activities currently cover all the groups of cryptogams: cyanobacteria, algae, fungi (including lichens) and bryophytes, vascular plants and plant communities.

The results of research are widely used in basic and applied research in botany and in other biological sciences. They are employed in the evaluation of the current state of biodiversity of the Slovak Republic, in the preparation of Red lists of endangered taxa, and in corresponding legislature. Publications of the Institute such as *Flora of Slovakia*, *Vegetation of Slovakia*, or *Checklist of non-vascular and vascular plants of Slovakia* are widely used as reference manuals, which cannot be replaced by any other publication from abroad. On the other hand, such publications often represent fundamental information sources on the flora and vegetation of Slovakia for researchers from abroad, who either study some plant species occurring in Slovakia or need information about the country flora to generate a wider image of European biodiversity. The Institute regularly cooperates with the Ministry of Environment of the Slovak Republic (being also

represented in the advisory board to the Minister of Environment for the biodiversity issues) and with all levels or organisations of the State Nature Conservancy of the Slovak Republic.

The Institute takes part also in several European and world-scale projects focused on the biodiversity studies, such as Species Plantarum – Flora of the World, Euro+Med PlantBase, Atlas florae europaeae, Global Taxonomic Initiative, Global Biodiversity Information Facility, Natura 2000. During the evaluation period the Institute substantially participated in identification of Important Plant Areas on the territory of Slovakia, which was organized by Plantlife International. Here we contributed mainly with the knowledge of the flora of the Slovak Republic and/or the Carpathians and Pannonia. Team of stress physiologists was involved in the study of the chilling tolerance of thermophilic crops (COST action 814), and multifunctional rural development model based on organic and competitive agriculture (CADSES INTERREG III B, and COST 835). Recently, our experience with Al toxicity in plants is the main reason why we are involved in large cooperation project among 13 European and South American institutions aimed at solving the problems with agricultural crop productivity in environmentally constrained South American (Brasilia, Chile, Uruguay, Argentina) soils (FP6-517617 Bridging genomics and agrosystem management: Resource for adaptation and sustainable production of *Lotus* spp. in environmentally constrained South American soils).

Taxonomic and phylogenetic studies performed in the Institute contribute to the research field of plant systematics and evolution, addressing taxonomic problems of some genera and species groups, as well as phenomena like polyploidisation, hybridisation, and plant speciation. The results are published in high-ranked international journals and frequently cited by researchers from abroad. An example of our participation in global initiatives is a recently launched initiative called 'Brassicaceae Phylogeny Working Group'. This working group, being so far a non-funded initiative, aims at promoting collaboration among research teams, coordination of research activities and projects, as well as generating a network of researchers and teams working with this economically important plant family throughout the world. The genus *Cardamine*, our long-term study object where lots of data had been gathered, has been successfully proposed as one of the model genera that will be subjected to a wide range of detailed studies employing the most recently developed methods.

Besides solving scientific projects the Institute functions as a nursery to carry out master and PhD theses in all botanical disciplines. The scientists of the Institute give lectures, practical courses, pre-master and master degree internships for universities, mostly at the Faculty of Natural Sciences of the Comenius University, Bratislava, but also at other Universities abroad (especially at the Charles University in Prague, Czech Republic).

The Institute organizes scientific seminars and symposia, both national and international. Among them, the most important are international symposia with long tradition "International Symposium on Biology and Taxonomy of Green algae" (the fifth one will be held in 2007; see http://ibot.sav.sk/symposium_smolenice06.html) and "Plant root structure and function" (the sixth one was held in 2003). The Institute is also in charge of the organisation of the Xth International Organisation of Plant Biosystematists Symposium, which will be held in 2008 in Slovakia. These events strengthen the international and national status of the Institute of Botany. The outcomes and the events promote not only a scientific discipline, but also the Slovak Academy of Sciences as well as the country.

iii. Objectives of the Concept

Most of the research themes of the Concept represent an integral part of the European research area "Sustainable development, global change and ecosystems". Application of the results addresses cross-cutting activities, e.g. research for policy support, in terms of national environmental policy. It is a substantial contribution to the "knowledge triangle" – research, education and innovation. The research concept set for the following four years commits to address

the increasing importance of the knowledge on the biodiversity and its conservation as is recognized by the EU and the member states and enshrined in law as well as international treaties (e.g. Convention of Biological Diversity, Natura 2000, Carpathian Convention). The concept is based on running of currently prepared projects and deals with the following issues:

Department of Vascular Plant Taxonomy

(1) Continuation of the inventory of the diversity of the ferns and flowering plants in Slovakia, resulting in subsequent volumes of the Flora of Slovakia, Identification key of the ferns and flowering plants of Slovakia, and Checklist of the ferns and flowering plants of Slovakia. These fundamental works represent not only inevitable background for further studies on taxonomy and evolution of these plant groups, but also serve as irreplaceable tools for all who are dealing with plants in biodiversity conservation, forestry, agriculture, etc.

(2) Participation in the large scale European and global taxonomic projects and initiatives, such as the virtual European Institute of Taxonomy (6FP project EDIT), Species Plantarum – Flora of the World, Euro+Med PlantBase, Atlas florae europaeae, Global Taxonomic Initiative, Global Biodiversity Information Facility, providing contributions representing our geographical area of research.

(3) Taxonomic and phylogenetic studies of selected genera and species groups, among others *Alyssum*, *Arabidopsis*, *Cardamine*, *Picris*, *Senecio*, *Viola*, using most advanced methodological approach and combination of methods as karyology, multivariate morphometrics and molecular systematics. The aim is to improve our understanding of the taxonomy and phylogenetic relationships in these groups, and to contribute to further development of methodological approaches used in taxonomy in general. Special attention should be paid to the phenomena of polyploidy and reticulation as important evolutionary forces.

Department of Non-Vascular Plants

(1) Analysis of diversity and distribution of phytoplankton in relation to the temperature gradient of thermal springs in Piešťany and Sklené Teplice.

(2) Nomenclatural studies in macromycetes described from the Western Carpathians.

(3) Taxonomical studies of selected systematic units within macromycetes and phytopathogenic fungi in Slovakia.

(4) Complex research of lichens, species structure, taxonomic questions and phytogeography within selected areas in Slovakia, solving relevant taxonomic problems, identification of lichen diversity drivers and application of the results for habitat status assessment, investigation of the impact of changes in air quality of urban agglomeration of Bratislava on lichens, assess the impact after 1989, uncover the extent of local environmental burden through the research on accumulation of ecotoxins in lichens and evaluate capacity of immission burden on health of citizens.

(5) Research in species structure of bryophytes in the selected areas of Slovakia with an emphasis on the taxa of European importance (including relics and endemites).

Department of Geobotany

(1) Study of variability and diversity of vegetation cover of the whole Slovakia will result in the next books of the series Vegetation of Slovakia, dedicated to meadow and forest vegetation, and the List of diagnostic, constant and dominant species of vegetation classes and alliances of Slovakia.

(2) Detailed regional research will be aimed at Borská nížina Lowland, Malá Fatra Mts., and Muránska planina Mts. Processing of phytocoenological data and their transformation into the maps with the help of the GIS programs will result in the interpretation of spatial and temporal changes in vegetation, in the design of vegetation predictive models of succession, and in the application of the appropriate ways of vegetation and habitat management.

(3) The obtained results, together with the extended database of phytocoenological relevés, will become a basis for working out a map of real vegetation with the help of geographic information system (GIS). For detailed knowledge of plant biodiversity in Slovakia, the research focused on variability of plant communities and their actual distribution is irreplaceable.

(4) Further international co-operation in the form of post-graduate studies and participation in the international projects is aimed at continuation of the highest level of geobotanical science in Slovakia in collaboration with leading vegetation science centres in the Netherlands, Germany, the Czech Republic or Austria. We will proceed in replenishing of our Central database of phytocoenological relevés and in the data exchange at pan-European level, providing the adequate data for large-scale syntaxonomical revisions and for mapping of biodiversity of various vegetation types; in searching for sets of diagnostic species based on the extensive data files; in evaluation of their threat and rarity at different levels - from regional to the European ones.

Department of Plant Physiology

(1) The aim of future projects from the field of functional anatomy will focus on regulation of the polarity of the growing plant cells like root hairs. Main aspects will be

- developmental role of plasma membrane and cell surface in the control of plant cell elongation by means of regulation of the targeted molecular movement;
- development and maintaining of the particular growth mode under changing conditions of the environment.

(2) Molecular investigations of tolerance mechanisms, especially expression of genes involved in metal tolerance (PCs, MTs), drought stress (PIP, TIP) and genes involved in internal detoxification of plant cells from toxic metals and reactive oxygen species (oxidative stress) produced almost generally by different stresses.

(3) Knowledge of mechanism of protein localisation in the tip of root hairs and signalling background of tip growth. We will characterize integrity of growing tip, interactions of plasma membrane with the cell wall, distribution of structural sterols and cell wall components and involvement of endocytosis in different developmental stages of root hairs. In addition, influence of environmental stress factors on the process of root hair formation will be focused in particular. Progress in this field will contribute to better understanding of developmental processes in plant cells that are based on internal polarity.

iv. Proposed strategies and methods to be applied, and time schedule

The research at the Department of Vascular Plant Taxonomy combines classical taxonomical approach with the application of the most advanced taxonomical and evolutionary methods. The classical taxonomic studies using the methods of chorology, morphology and botanical nomenclature resulted in the multivolume work Flora of Slovakia [Flóra Slovenska] and Checklist of non-vascular and vascular plants of Slovakia (available as a book, CD and also an online database). This is clearly the background on which further research will be based. Subsequent volumes of the Flora of Slovakia, the Identification key of the ferns and flowering plants of Slovakia and the new edition of the Checklist of the ferns and flowering plants will be published within the next four years. The application of the most advanced taxonomical methods aims to solve problems of taxonomy, evolution and phylogenetic relationships, and hybridisation in critical species groups in the Carpathian and Pannonian area, but also in other parts of Europe and in some cases also well beyond the borders of our continent. The phylogeographic aspect was recently added as well, and will be further developed. The genera on which we will concentrate in the next four years will include, among others *Arabidopsis*, *Cardamine* and *Alyssum* (Brassicaceae), *Viola* (Violaceae), *Hieracium*, *Pilosella*, *Picris*, and *Senecio* (Asteraceae). From among the methods being applied karyological ones should be mentioned first. There is a long-term tradition of research on polyploid complexes and the phenomenon of polyploidy in Slovakia (established already in the early 1960s at the Department of Botany of the Comenius University), which is further developed at the Institute of

Botany. Chromosome number survey of the ferns and flowering plants, which is in print and available as an online database, summarises previous research on this topic in Slovakia and provides a good background for further studies. Recently applied flow cytometry (so far in cooperation with laboratories at other institutions) brings a new dimension to the karyological research, giving the possibility to screen a vast amount of plant individuals. Flow cytometer is the first on the list of equipments, which should be purchased in a near future. Methods of multivariate morphometrics are widely applied and our results are often cited as examples of the proper application of this approach. Methods of molecular systematics (isozymes, cp and nrDNA sequences, PCR-RFLP, AFLP) were used until recently in cooperation with some of the leading institutions in Europe, but the recently established laboratory gives the possibility to carry out such analyses in the Institute itself. Still, cooperation with several institutions abroad is needed to keep in touch with the most recent developments in this area. The Institute has well-developed contacts to several leading institutions in Europe, as well as in some non-European countries. Last but not least, problems of finding correct names for plants studied, namely application of the International Code of Botanical Nomenclature, receives and should receive proper attention as well. K. Marhold is one of the editors of the current version of the Code.

In the Department of Non-Vascular Plants all the methods recently used in Europe for particular problems in all the spheres covered by "cryptogamology" will be applied. Timeframe follows the time schedules of the particular on-going projects.

In the Department of Geobotany methods of traditional geobotany are supplied by wide spectrum of advanced methods of numerical syntaxonomy, statistical exploitation of large data sets, multivariate analyses etc. They all help us in preparation of next volumes of survey of plant communities of Slovakia and the List of diagnostic, constant and dominant species of vegetation classes and alliances of Slovakia. At the same time, new methods developed in vegetation science, e.g. biodiversity measurement, modelling of vegetation changes and dynamics, and tools for detailed studies of relation between vegetation and environment will be adopted. The crucial role for the next years represents training of young researchers and post-doc students in institutes and universities abroad, and an intensive co-operation with researchers from abroad on preparation of joint projects.

III. Partial indicators of the main activities:

1. Research output

- i. List of the selected publications documenting the most important results of basic research. Total number of publications in the whole assessed period should not exceed the average number of the research employees**

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- [10] **ERMAKOV, N. - CHYTRÝ, M. - VALACHOVIČ, M.** Vegetation of the rock outcrops and screes in the foreststeppe and steppe belts of the Altai and Western Sayan Mts., southern Siberia. In *Phytocoenologia*. Vol. 36, no. 4 (2006), p. 509-545. (0,741 - IF2005)
- [11] **FRATI, L. - CAPRASECCA, E. - SANTONI S. - GAGGI C. - GUTTOVÁ, A. - GAUDINO, S. - PATI, A. - ROSAMILIA, S. - PIRINTSOS, S. A. - LOPPI, S.** Effects of NO₂ and NH₃ from road traffic on epiphytic lichens. In *Environmental Pollution*. Vol. 142, no. 1 (2006), p. 58-64. (2,451 - IF2005)
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- [35] **MRÁZ, P. Ed., KOCHJAROVÁ, J. - KOLNÍK, M. - GOLIAŠOVÁ, K. - HODÁLOVÁ, I. - MEREĎA, P. jun. - MRÁZ, P. - MÁRTONFI, P. - KOLARČÍK, V. - PERNÝ, M. - ŠIPOŠOVÁ, H.** Chromosome number and DNA ploidy level reports from Central Europe. In *Biologia*. Vol. 61, no. 1 (2006), p. 115-120. (0,240 - IF2005).
- [36] **NIKETIĆ, M. - VLADIMIROV, V. - MRÁZ, P.** Chromosome numbers and taxonomic-chorological notes on selected species of *Hieracium* s. str. (*Asteraceae*) from Montenegro. In *Phytologia Balcanica*. Vol. 12, no. 1 (2006), p. 85-97.
- [37] **OŤAHEĽOVÁ, H. - OŤAHEĽ, J.** Distribution of aquatic macrophytes in pit lakes in relation to the environment (Borská nížina lowland, Slovakia). In *Ekológia (Bratislava)*. Vol. 25, no. 4 (2006), p. 398-410. (SCOPUS, CAB Abstracts, Biological Abstracts)
- [38] **OŤAHEĽOVÁ, H. - VALACHOVIČ, M.** Diversity of macrophytes in aquatic habitats of the Danube River (Bratislava region, Slovakia). In *Thaiszia - Journal of Botany*. Vol. 16 (2006), p. 27-41. (BIOSIS, CAB Abstracts)
- [39] **PALOVE-BALANG, P. - KISOVÁ, A. - PAVLOVKIN, J. - MISTRÍK, I.** Effect of manganese on cadmium toxicity in maize seedlings. In *Plant Soil and Environment*. Vol. 52 (2006), p. 143-149. (SCOPUS, AGRICOLA, AGRIS, CAB Abstracts)
- [40] **PAVLOVKIN, J. - MISTRÍKOVÁ, I. - LUXOVÁ, M. - MISTRÍK, I.** Effect of beauvericin on root cell transmembrane electric potential, electrolyte leakage and respiration of maize roots with different susceptibility to *Fusarium*. In *Plant Soil and Environment*. Vol. 52 (2006), p. 492- 498. (SCOPUS, AGRICOLA, AGRIS, CAB Abstracts)
- [41] **PERNÝ, M. - TRIBSCH, A. - ANCHEV, M. E.** Intraspecific differentiation in the Balkan diploid *Cardamine acris* (*Brassicaceae*): molecular and morphological evidence. In *Folia Geobotanica*. Vol. 39, no. 4 (2004), p. 405-429.(1,057 - IF2003)
- [42] **RUŽIČKOVÁ, H. - BANÁSOVÁ, V. - KALIVODA, H.** Morava River alluvial meadows on the Slovak-Austrian border (Slovak part): plant community dynamics, floristic and butterfly diversity - threats and management. In *Journal for Nature Conservation*. Vol. 12, no. 3 (2004), p. 157-169.
- [43] **SCHLICHT, M. - STRNAD, M. - SCANLON, M. J. - MANCUSO, S. - HOCHHOLDINGER, F. - PALME, K. - VOLKMANN, D. - MENZEL, D. - BALUŠKA, F.** Auxin immunolocalization implicates vesicular neurotransmitter-like mode of polar auxin transport in root apices. In *Plant Signal Behavior*. Vol. 1 (2006), p. 122-133.
- [44] **ŠIBÍK, J. - PETRÍK, A. - KLIMENT, J.** Syntaxonomical revision of plant communities with *Carex firma* and *Dryas octopetala* (alliance *Caricion firmae*) in the West Carpathians. In *Polish Botanical Journal*. Vol. 49, no. 2 (2004), p. 150-170.
- [45] **ŠIBÍK, J. - KLIMENT, J. - JAROLÍMEK, I. - DÚBRAVCOVÁ, Z. - BĚLOHLÁVKOVÁ, R. - PACLOVÁ, L.** Syntaxonomy and nomenclature of the alpine heaths (the class *Loiseleurio-Vaccinietaea*) in the Western Carpathians. In *Hacquetia, Ljubljana*. Vol. 5 no. 1 (2006), p. 37-71. (CAB Abstracts)
- [46] **ŠMARDA, J. - HINDÁK, F.** Conspicuous forms of keritomic thylakoids in *Trichormus variabilis*. In *Archiv für Hydrobiologie. Algological Studies. Stuttgart*. Vol. 117 (2005), p. 407-414. (1,020 - IF2004)
- [47] **ŠROBÁROVÁ, A. - NADUBINSKÁ, M. - EGED, Š. - KOGAN, G. - ALTOMARE, C. - MORETTI, A.** The possibility of using biological control agents to reduce maize root rot caused by *F. verticillioides*. In *Acta fytotechnica et zootechnica*. Vol. 6, no. 4 (2004), p. 85-89.
- [48] **VALACHOVIČ, M.** Syntaxonomy of the fringe vegetation in Slovakia in relation to surrounding areas - preliminary classification. In *Haquetia, Ljubljana*. Vol. 3, no. 1 (2004), s. 9-25.
- [49] **VALENTOVIČ, P. - LUXOVÁ, M. - KOLAROVIČ, L. - GAŠPARÍKOVÁ, O.** Effect of osmotic stress on compatible solutes content, membrane stability and water relations in two maize cultivars. In *Plant, Soil and Environment*. Vol. 52, no. 4 (2006), p. 186-191. (SCOPUS, AGRICOLA, AGRIS, CAB Abstracts)

v. Table of research outputs

Table **Research outputs** shows research outputs in number of specified entries; these entries are then divided by FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).

Research outputs	2003			2004			2005			2006			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
chapters in monographs, books published abroad	4	0,09	0,25	2	0,04	0,12	0	0,00	0,00	9	0,18	0,51	15	3,8	0,08	0,23
chapters in monographs, books published in Slovakia	27	0,60	1,71	0	0,00	0,00	4	0,08	0,24	10	0,20	0,56	41	10,3	0,21	0,62
CC publications	38	0,84	2,40	31	0,65	1,91	43	0,91	2,56	42	0,82	2,37	165	38,5	0,80	2,31
scientific publications indexed by other databases *)	8	0,18	0,51	8	0,17	0,49	14	0,30	0,83	15	0,29	0,85	45	11,3	0,24	0,68
scientific publications in other journals	35	0,78	2,22	50	1,04	3,08	39	0,83	2,32	33	0,65	1,86	157	39,3	0,82	2,36
publications in proc. of international scientific conferences	0	0,00	0,00	5	0,10	0,31	1	0,02	0,06	15	0,29	0,85	21	5,3	0,11	0,32
publications in proc. of nat. scientific conferences	3	0,07	0,19	7	0,15	0,43	2	0,04	0,12	2	0,04	0,11	14	3,5	0,07	0,21
active participations at international conferences	62	1,38	3,92	73	1,52	4,50	51	1,08	3,03	37	0,72	2,09	223	55,8	1,17	3,35
active participations at national conferences	23	0,51	1,46	41	0,85	2,53	19	0,40	1,13	16	0,31	0,90	99	24,8	0,52	1,49

*) SCOPUS, BIOSIS, AGRIS, AGRICOLA, Excerpta Medica, CAB Abstracts, Biological Abstracts

vi. Renormalized publications²

Renormalized publications = number of CC publications in the given year times authorship's portion of the Organisation times the journal impact factor in 2005 divided by the median impact factor in the research field

² This information is required only from the Organisations of the Section 2 of the Slovak Academy of Sciences.

Renormalised publications	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
Renormalized publications	24,9	0,55	1,58	18,8	0,39	1,16	16	0,34	0,95	31,5	0,62	1,78

vii. Standard manuscript page count³

Standard manuscript page count	2003			2004			2005			2006		
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget
page count	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0

viii. List of patents and patent applications

none

ix. Supplementary information and/or comments on the scientific output of the Organisation

Expert teams oriented to the biodiversity research (Department of Non-Vascular Plants, Department of Vascular Plant Taxonomy, and Department of Geobotany) publish their research results in a wide spectrum of scientific media. Most significant results are published in the journals included in the ISI databases (CC, WOS, etc.), being the crucial indicator of the fundamental research activities. Important information on the flora and vegetation of Slovakia is published in monographs (Floras, checklists, identification keys, vegetation surveys, etc.). They are related to the local flora and vegetation, for the conservation of which Slovakia has an ultimate responsibility, and as such cannot be replaced by any other publications from abroad. At the national scale they serve as reference manuals for botanists and those working in other branches of science (e.g. zoology, ecology, forestry, etc.), for teachers and students at high schools and universities, and for practical purposes of the nature conservancy. On the other hand, they serve at international scale as important information sources on the flora and vegetation of Slovakia for researchers from abroad who either study some plant species occurring in Slovakia or need information about the country

³ This information is required only from the Organisations of the Section 3 of the Slovak Academy of Sciences.

flora and vegetation to generate a wider picture of European biodiversity. Recently several important publications presenting syntheses of the regional biodiversity information were made available for the home and oversee cooperating institutions, universities, libraries and nature conservancy bodies. Results of regional scale biodiversity research are published in Slovak language to cultivate national botanical terminology and to approach the main target groups of readers. Nevertheless, most important information from these publications is accessible also to those whose mother tongue is other than Slovak via lists of taxa and localities, distribution maps, synonymies, etc. Expert teams oriented to experimental research (Department of Plant Physiology) publish nearly all results in well-impacted international journals.

2. Responses to the scientific output

Table **Citations** shows specified responses to the scientific outputs; these entries are then divided by the FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).

Citations	2002			2003			2004			2005			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Web of Science	339	7,5	21,5	416	8,7	25,7	383	8,1	22,8	474	9,3	26,7	1612	403,0	8,4	96,9
Databese SCOPUS	0	0,0	0,0	1	0,0	0,0	9	0,0	0,5	36	0,7	2,0	46	11,5	0,2	2,8
Other primary resources (journals, proceedimngs)	260	5,8	16,5	314	6,5	19,4	514	10,9	30,6	261	5,1	14,7	#####	337,3	7,0	81,1
in monographs, conf. proceedings and other publications abroad	42	0,9	2,7	17	0,4	1,0	51	1,1	3,0	42	0,8	2,4	152	38,0	0,8	9,1
in monographs, conf. proceedings and other publications in Slovakia	25	0,6	1,6	43	0,9	2,7	55	1,2	3,3	22	0,4	1,2	####	36,3	0,8	8,7

i. List of 10 top-cited publications and number of their citations in the assessment period

[1] MARHOLD, K. - HINDÁK, F. (eds) Zoznam nižších a vyšších rastlín Slovenska. Checklist of non-vascular and vascular plants of Slovakia. Bratislava: Veda, 1998, 687 s.
179 (WOS: 34, monographs: 16, others: 129)

[2] FERÁKOVÁ, V. - MAGLOCKÝ, Š. - MARHOLD, K. Červený zoznam papraďorastov a semenných rastlín Slovenska. In Červený zoznam rastlín a živočíchov Slovenska. Ochrana prírody. Roč. 20, Supplement (2001), s. 44-80.
90 (WOS: 1, others: 89)

[3] BALUŠKA, F. - SALAJ, J. - MATHUR, J. - BRAUN, M. - JASPER, F. - ŠAMAJ, J. - CHUA, N. H. - BARLOW, P.W. - VOLKMANN, D. Root hair formation: F-actin-dependent tip growth is initiated by local assembly of profilin-supported F-actin meshworks accumulated within expansin-enriched bulges. In *Developmental Biology*. Vol. 227, no. 2 (2000), p. 618-632.
69 (WOS: 62, SCOPUS: 2, monographs: 5)

[4] LIZOŇ, P. - BACIGÁLOVÁ, K. (eds) Huby. In Marhold K., Hindák F. (eds) Zoznam nižších a vyšších rastlín Slovenska. Bratislava: Veda, 1998, s. 101-227.
61 (WOS: 13, monographs: 16, others: 32)

[5] MARHOLD, K. - GOLIAŠOVÁ, K. - HEGEDŮŠOVÁ, Z. HODÁLOVÁ, I. - JURKOVIČOVÁ, V. - KMEŤOVÁ, E. - LETZ, R. - MICHALKOVÁ, E. - MRÁZ, P. - PENIAŠTEKOVÁ, M. - ŠIPOŠOVÁ, H. - ŤAVODA, O. Papraďorasty a semenné rastliny. In Marhold K., Hindák F. (eds) Zoznam nižších a vyšších rastlín Slovenska. Bratislava: Veda, 1998, s. 343-687
58 (WOS: 11, monographs: 2, others: 45)

[6] JAROLÍMEK, I. - ZALIBEROVÁ, M. - MUCINA, L. - MOCHNACKÝ, S. Rastlinné spoločenstvá Slovenska. Bratislava: Veda, 1997, 420 s.
45 (WOS: 5, monographs: 7, others: 33)

[7] VALACHOVIČ, M. - OŤAHEĽOVÁ, H. - STANOVÁ, V. - MAGLOCKÝ, Š. Rastlinné spoločenstvá Slovenska I. Bratislava: Veda, 1995, 185 s.
43 (WOS: 5, monographs: 8, others: 30)

[8] VALACHOVIČ, M. - HÁBEROVÁ, I. - HÁJEK, M. - HRIVNÁK, R. - JAROLÍMEK, I. - OŤAHEĽOVÁ, H. - ŠOLTÉS, R. - ZALIBEROVÁ, M. Rastlinné spoločenstvá Slovenska III. Vegetácia mokradí. Bratislava: Veda, 2001, 434 s.
39 (WOS: 9, monographs: 5, others: 25)

[9] BALUŠKA, F. - HASENSTEIN, K. H. Root cytoskeleton: its role in perception of and response to gravity. In *Planta*. Vol. 203 (1997), S69-S78 Suppl. S.
38 (WOS: 35, SCOPUS: 3)

[10] KUBINSKÁ, A. - JANOVICOVÁ, K. Machorasty. In Marhold, K., Hindák, F. (eds) Zoznam nižších a vyšších rastlín Slovenska. Bratislava: Veda, 1998, s. 297-332
28 (WOS: 4, monographs: 1, others: 23)

ii. List of top-cited authors from the Organisation (at most 10 % of the research employees) and their number of citations in the assessment period

[1] František Baluška: 613

[2] Karol Marhold: 373

[3] František Hindák: 342

[4] Milan Valachovič: 190

iii. Supplementary information and/or comments on responses to the scientific output of the Organisation

Expert teams oriented to the biodiversity research (Department of Non-Vascular Plants, Department of Vascular Plant Taxonomy, and Department of Geobotany) publish their research results in a wide spectrum of scientific media. Most significant results are published in the journals included in the ISI databases (CC, WOS, etc.), being the crucial indicator of the fundamental research activities. Important information on the flora and vegetation of Slovakia is published in monographs (Floras, checklists, identification keys, vegetation surveys, etc.). They are related to the local flora and vegetation, for the conservation of which Slovakia has an ultimate responsibility, and as such cannot be replaced by any other publications from abroad. At the national scale they serve as reference manuals for botanists and those working in other branches of science (e.g. zoology, ecology, forestry, etc.), for teachers and students at high schools and universities, and for practical purposes of the nature conservancy. On the other hand, they serve at international scale as important information sources on the flora and vegetation of Slovakia for researchers from abroad who either study some plant species occurring in Slovakia or need information about the country flora and vegetation to generate a wider picture of European biodiversity. Recently several important publications presenting syntheses of the regional biodiversity information were made available for the home and oversee cooperating institutions, universities, libraries and nature conservancy bodies. Results of regional scale biodiversity research are published in Slovak language to cultivate national botanical terminology and to approach the main target groups of readers. Nevertheless, most important information from these publications is accessible also to those whose mother tongue is other than Slovak via lists of taxa and localities, distribution maps, synonymies, etc. Expert teams oriented to experimental research (Department of Plant Physiology) publish nearly all results in well-impacted international journals.

3. Research status of the Organisation in the international and national context

- **International/European position of the Organisation**

i. List of the most important research activities documenting international importance of the research performed by the Organisation, incl. major projects (details of projects should be supplied under Indicator 4). Collective membership in the international research organisations, in particular within the European Research Area

The importance of research activities as well as the engagement of the Institute in the international research on plant sciences can be referred from the following survey of

projects revealing the scientific subjects and the results/publications resulting from international collaboration:

A. Multilateral projects of the International Scientific and Technical Collaboration

Fifth Framework Programme

[1] European Initiative for the Euro+MedPlant Base, 2000-2003

The project resulted in establishing the structure of the complex information system of ferns and flowering plants in Europe. The first version of the synonymic catalogue of the ferns and flowering plants of Europe was prepared, which is currently being edited by a group of editors. The purpose of this catalogue is to serve as the reference list for the basic and applied research as well as for the European administrative. The first outputs are already available for public on-line on <http://ww2.bgbm.org/EuroPlusMed/query.asp>

[2] BioCASE – A Biodiversity Collection Access Service for Europe, 2001-2005

The project was aimed at establishing the European biodiversity information system covering botanical and zoological collections and collections of micro-organisms. This system is important not only for the biodiversity research, but also for national and EU administrative and institutions competent in practical and legal protection of biodiversity. The results of the project and access to the databases are available on the web page www.biocase.org. A potential user of the collection can get information on scientific profile and collections of an institution, on the content of the collections, and about the possibilities of their scientific exploration.

[3] ENBI - European Network for Biodiversity Information, 2003-2005

Within this project, European activities in the biodiversity information management were coordinated. The project represented contribution of European Union towards global biodiversity information network (GBIF, Global Biodiversity Information Facility). The Institute of Botany SAS as the National node of the GBIF, and a national centre of ENBI mediates the access to the data on type specimens of the Herbarium SAV and other resources in Slovakia. Training seminar on biodiversity information and informatics was organised for young PhD students and post-docs in Prague in cooperation with the Institute of Botany.

Sixth Framework Programme

[1] Tracking surrogates for infraspecific biodiversity: towards efficient selection strategies for the conservation of natural genetic resources using comparative mapping and modelling approaches (INTRABIODIV), 2004–2006

This project dealt with an infraspecific genetic variation of selected species (using molecular markers) as well as with the floristic variation in the areas above timber-line of the Alps and Carpathians. Our aim was to find out to which extent these two factors are correlated and how this correlation can be used in improving the network of protected areas. Ample material has been collected, the floristic diversity documented by the means of network mapping and genetic diversity accomplished in 30 species. The resulting data were synthesized and are prepared for publication. From among the expected publication outputs with considerable contribution of the Institute of Botany, the following should be mentioned: a book "Distribution atlas of the high mountain vascular plants of the Alps and Carpathians", and papers entitled "Genetic diversity is not congruent with species richness in alpine plants" (invited to the journal Science), "Tracking surrogates for

intraspecific biodiversity”, “Checklist of the high mountain taxa of the flora of the Alps and Carpathians”, “Phylogeography of the *Sempervivum montanum* group”, and “Genetic diversity and phylogeography of two high mountain species – *Dryas octopetala* and *Loiseleuria procumbens* in the Alps and Carpathians”.

[2] European Native Seed Conservation Network (ENSCONET), 2004-2009

International network established within this project will provide an opportunity for coordination of activities in collecting and preservation of the seed material of endangered plant species (preparing detailed methods of collection and preservation of seeds, and priority species lists). Using molecular approach, the project will also deal with genetic variation of endangered species in relation to their survival possibilities. The contribution of the Institute of Botany SAS dwells in updating the Checklist of ferns and vascular plants of Slovakia preceding the selection of species with priority in collection and seed conservation. Preliminary list of endemic species and seed collection in Western Carpathians was assembled.

[3] Molecular and cellular mechanisms of tip growth in plant cells, 2002-2005

The object of the study was the tip growth of root hairs focused on the characterization of polar distribution of the organelles and alterations of their distribution in unfavourable conditions, the dynamic behaviour of fine cellular structures, and the dependence of transport processes on the cytoskeleton as well as on plasma membrane components. We used methods of live cell imaging, immunofluorescence and Green Fluorescent Protein technology.

ŠAMAJ J., BALUŠKA F., MENZEL D. New signalling molecules regulating root hair tip growth. Trends Plant Sci., Vol. 9(5), (2004), p. 217-20

OVEČKA M., LICHTSCHEIDL I., BALUŠKA F., ŠAMAJ J., VOLKMANN D., HIRT H. (2004) Regulation of root hair tip growth: can mitogen-activated protein kinases be taken into account? In: NATO Science Series 978901 - The plant cytoskeleton: functional diversity and biotechnological implications, in press

OVEČKA M., LANG I., BALUŠKA F., ISMAIL A., ILLÉŠ P., LICHTSCHEIDL I.K. Endocytosis and vesicle trafficking during tip growth of root hairs. Protoplasma. Vol. 226 (2005), p. 39-54

VOIGT B., TIMMERS T., ŠAMAJ J., MÜLLER J., BALUŠKA F., MENZEL D. (2005) GFP-FABD2 fusion construct allows *in vivo* visualization of the dynamic actin cytoskeleton in all cells of *Arabidopsis* seedlings. Eur J Cell Biol 84: 595-608

[4] Towards the European Distributed Institute of Taxonomy (EDIT), NoE, 2006–2011

A network of excellence established by the project aims at coordinating the high quality taxonomic research throughout Europe. During the first year of the project coordination of software and hardware equipment has been proposed and tested, that should enable a fluent information exchange between the partner institutions. Registration of taxonomic courses carried out by the partner institutions but also other European universities and research institutes has started, with the aim of increasing the quality of pregradual and postgradual studies of plant and animal taxonomy.

[5] Bridging genomics and agrosystem management „Resource for adaptation and sustainable production of *Lotus* spp. in environmentally constrained South American soils”, 2005-2008

Mechanisms of metal tolerance in economically important plant species have been studied with respect to their structural and metabolic responses. The aim of the project is to find most convenient tolerant species suitable for cultivation in the target countries.

PALOVE-BALANG P., PAVLOVKIN J.: Manganese and cadmium toxicity on nitrate metabolism in young maize seedlings. VIII. Reunión del Metabolismo del Nitrógeno, Lanzarote, Španielsko, 24. – 27. 5. 2006

[6] Participation of endomembranes and components of the cell wall in the maintenance of plant cell polarity, 3/2006–2/2007

The most important results were obtained in the live cell microscopy of control and transgenic plants. A sophisticated methodical approach was managed by the means of up-to-date confocal laser microscopy, and videomicroscopy. We established a new laboratory of confocal microscopy that will meet the criteria of non-invasive study of the living plant material, using the modern microscopic equipment with high resolution. Applying such methods we characterized aluminium toxicity in the plants affecting the root growth, changes in root cell membrane potential, and signal molecule production.

ILLÉŠ P., SCHLICHT M., PAVLOVKIN J., LICHTSCHEIDL I.K., BALUŠKA F., OVEČKA M. (2006): Aluminium toxicity in plants: internalization of aluminium into cells of the transition zone in *Arabidopsis* root apices related to changes in plasma membrane potential, endosomal behaviour, and nitric oxide production. *J. Exp. Bot.*, 57: 4201-4213.

ILLÉŠ P., SCHLICHT M., PAVLOVKIN J., LICHTSCHEIDL I.K., BALUŠKA F., OVEČKA M. (2006) Sensitivity of the *Arabidopsis* root cells to aluminium: dependence on the cell developmental stage. In *Proceedings I (IX) Conference of young Botanists in Saint-Petersburg, May 21 - 26, 2006*, , p. 224 - 225.

LICHTSCHEIDL I.K., OVEČKA M., BALUŠKA F. The role of actin filaments in tip growth of root hairs. In *16. Tagung des Österreichischen Arbeitskreises für Pflanzenphysiologie*, Mauterndorf, Austria, 15. - 18. 6. 2006, p. 59-60.

OVEČKA M., BALUŠKA F., LICHTSCHEIDL I.K. Non-invasive microscopy of tip growing root hairs as a tool for study of dynamic, cytoskeleton-based processes. In *Book of abstracts, The Plant Cytoskeleton: Genomic and Bioinformatic Tools for Biotechnology and Agriculture*, Yalta, September 19-23, 2006, p. 74-76.

COST

[1] Agriculturally important toxigenic fungi, COST 835, 1998-2003

The occurrence of potentially toxigenic *Fusarium* species involved in head and ear blight of wheat and maize had been monitored in Slovakia during three years. Beside the most frequent *F. culmorum*, the species *F. graminearum*, *F. sambucinum* and rarely also *F. pseudocerealis* were involved. Each of these species is a potential producer of the mycotoxins trichothecenes and zearalenone. Some of the structural and physiological responses of the host plants were identified. **ŠROBÁROVÁ A.** 2001: *Fusarium* spp. on cereals in Slovakia, pp.159-165. In: LOGRIECO A. (ed.), Occurrence of toxigenic fungi and mycotoxins in plants, food and feed in Europe, COST Action 835, Office for official publications of the European Communities, Luxembourg.

NADUBINSKÁ M., RITIENI A., MORETTI A., ŠROBÁROVÁ A. (2003) Chlorophyll content in maize plants after treatment with fusariotoxins. In *Biologia*. Vol. 58/1: 115-119.

ŠROBÁROVÁ A., KOGAN G., ALTOMARE C., MORETTI A. (2003) The possibility of maize ear rot control by *Trichoderma* and fungal cell wall polysaccharide. *Acta fytotechnica et zootechnica*. Vol. 2: 50-52.

CADSES INTERREG III B

[1] Production in organic farming - 2A018 SIMOCA, 2003-2005

The project dealt with investigating polysaccharide derivatives prepared from waste fungal material with antifungal activity and growth-stimulating properties of the host plant (tomato). Some mechanisms of this activity were elucidated. A strain of *Trichoderma* approved in laboratory conditions has been given over for field experiments for biological control in organic farming. Common transnational knowledge-based and permanent communication networking system on organic agriculture was established. Best-practice model in multifunctional and organic agriculture in selected areas was proposed and socio-economic and environmental evaluation of the model was elaborated.

ŠROBÁROVÁ A. South-west region of Slovakia .In „CADSES Project Report for meeting of the 3-4 July (2003), p.91-102.

ŠROBÁROVÁ A., KAKALÍKOVÁ L., DRIMAL J.: Agroecological characteristics of selected area of organic farming in Slovakia.“ Interreg IIIB Cades-SIMOCA Project WP2 – Transnational Workshop n° 3 , 29 - 30.3. 2004, Nitra, Slovakia.

KOGAN G. - ŠROBÁROVÁ A. - TAMÁS L. Effect of externally applied fungal polysaccharides on fusariosis of tomato plants. Chemical Papers, 58, 2, (2004), p. 139-144.

ŠROBÁROVÁ A. – EGED Š. Trichoderma and sulphoethyl glucan reduce maize root rot infestation and fusaric acid content. Plant Soil Environ. 51, (2005), p. 322-327.

ŠROBÁROVÁ A. Development of best-practice model at farm and catchments level in multifunctional and organic agriculture in selected areas in Slovakia, 73ps.

<http://www.simoca.org/programmi/webcreate.php?id=175&idarea=7>

CNR-NATO advanced research programme, Universita di Siena, Italy,

[1] Selection of a method for numerical interpretation of environmental quality on the grounds of lichen diversity, 7/2003-1/2004

A new method of interpretation of environmental quality related to existing diversity of epiphytic lichens in the studied area was found to be applicable also in the conditions of Slovakian territory.

GUTTOVÁ A.: Use of lichen indication in Slovakia. Presentation, University of Siena, Italy, 15. 11. 2003.

European Union, SYS-resource

[1] Genetic variation within British populations of *Leptogium turgidum* agg. (lichenized Ascomycetes) , 9/2003-10/2003

An analysis of genetic material of four lichen taxa of the originating from four European countries was performed. Altogether 204 DNA sequences were obtained.

GUTTOVÁ A.: Genetic variation within British populations of *Leptogium turgidum* agg. BLS, Presentation, Natural History Museum, London, 23.10.2003.

B. Bilateral projects – a survey of the collaborating institutions/countries and the common results/publications

➤ Masaryk University Brno, Czech Republic

[1] Vegetation diversity along a continentally gradient in southern Siberia: a key to understanding Early Postglacial history of Central Europe, 2003-2007

The results from field work in Altay (Čujskij trakt, Katuň) have been summarized.

ERMAKOV N., CHYTRÝ M., VALACHOVIČ, M. Vegetation of the rock outcrops and screes in the foreststeppe and steppe belts of the Altai and Western Sayan Mts, southern Siberia. *Phytocoenologia*. Vol. 36, no. 4 (2006), p. 509-545.

➤ **W. Szafer Institute of Botany, Polish Academy of Science, Krakow**

[2] Lichens in the Carpathians, 2002-2005

Data on lichen occurrence and bibliography were summarized from the territory of the West Carpathians. The checklist as the first stage of a compilation of current knowledge on lichen species diversity in the West Carpathians was published. Joint research and collection of lichens after the windstorm in 2004 was carried out in the calamity area.

BIELCZYK U., LACKOVIČOVÁ A., FARKAS E., LÖKÖS J., BREUSS O., KONDRATYUK S. YA., 2003: Checklist of lichens of the Western Carpathians. Inst. Botaniki im. Szafera PAN, Kraków, 2003, 184p.

LISICKÁ E., LACKOVIČOVÁ A.: Záchraný výskum lišajníkov v Tatrách. WEB SAV, 22.09.2005

LISICKÁ E., LACKOVIČOVÁ A., 2005: Kalamita v Tatrách verzus lišajníky. Správy SAV 10: 12.

LISICKÁ E., LACKOVIČOVÁ A., 2005: Lišajníky na kalamitných plochách. Tatro 5: 7.

LISICKÁ E., LACKOVIČOVÁ A., KYSELOVÁ Z., ŠLIWA L., BIELCZYK U., 2005: Lichenologiczny aspekt huraganu w Tatrach Słowackich. XXI Zjazd lichenologów Polskich, Porosty w krajobrazie Polski, Białystok, 12.-13. 09. 2005 (poster).

LISICKÁ E., 2006: Diversity of epiphytic lichens of the Tatro Mountains, Slovakia. In: Lackovičová et al. (eds), Central European lichens – diversity and threat, Mycotaxon Ltd., Ithaca, p. 283-304. Lackovičová A. et al. (eds), Central European Lichens – Diversity and Threat. Mycotaxon Ltd., Ithaca, 364p. 283-304.

[3] Cyanophytes and algae of the Carpathians; Euglenophyceae of Slovakia and Poland with special regard to boundary regions, 2002-2005

In samples collected from various habitats in W Slovakia, 43 taxa of the genus *Trachelomonas* (Euglenophyta) were found and studied in light and scanning electron microscopy. 31 taxa are new for Slovakia, and 3 taxa for the European flora.

WOŁOWSKI K., HINDÁK F., 2004: Loricae of *Trachelomonas* species from Slovakia. *Nova Hedwigia* 78: 179-207.

WOŁOWSKI K., HINDÁK F., 2005: Atlas of Euglenophyceae. Veda, Vydavateľstvo SAV, Bratislava, 136 pp, ISBN 80-224-0836-0

WOŁOWSKI K., HINDÁK F.: Taxonomy of *Strombomonas labiata*. *Perpared for publication*

CABALA S., HINDÁKOVÁ A.: Cysts and stromatocysts in *Uroglena* and *Dinobryon* (Chrysophyceae). *Perpared for publication*

[4] Diversity of phytopathogenic fungi and their host plants in the Tatro National Parks, 2002-2005

Common research on phytopathogenic micromycetes on the Slovak and Polish sides of the Tatra Mts. A new species for Carpathians has been determined. The first checklist of the families Protomycetaceae and Taphrinaceae and their host plants in this area has been submitted for publication.

BACIGÁLOVÁ K., PIATEK M., WOŁKOWYCKI M. *Protomyces cirsii – oleracei* (Fungi, Protomycetales) a new species for Poland. *Polish Botanical Journal* 50(1) Vol. 50, no. 1 (2005), p. 77-82.

BACIGÁLOVÁ K., HRIVNÁK R., KOCHJAROVÁ J., PIATEK M., VLČKO J. *Vankya vaillantii* (Ustilaginomycetes) on *Scilla* in Central Europe. *Polish Botanical Journal* 50(2) (in press)

➤ Institute of Biology, Maria Curie-Skłodowska University, Lublin, Poľsko

[5] Diversity of phytopathogenic micromycetes and their host plants in biospheric reserve Tatry National Park, 2004-2007

The knowledge on diversity and distribution of phytopathogenic micromycetes and their host-plants in National Reserve Tatry was extended. Joint field work in the Biosphere Reserve revealed three new species of the order Protomycetales and a new invasive fungal species *Melampsorium hiratsukanum*.

BACIGÁLOVÁ K., **MUŁENKO W.**, 2004: História a stav poznania diverzity fytopatogénnych mikroskopických húb v Tatranskom národnom parku. Štúdie o Tatranskom národnom parku 7 (40): 193-200.

MUŁENKO W., **BACIGÁLOVÁ K.** Parasitic microfungi of the Tatra Mountains. 4. *Melampsorium hiratsukanum*. *Polish Botanical Studies*. Vol. 22 (2005), p. 31-40.

MUŁENKO W., **BACIGÁLOVÁ K.**, **KOZŁOWSKA M.**: *Melampsorium hiratsukanum* an invasive species new for Tatra Mts. and Slovakia. *Acta mycologica* (v tlači).

➤ Institute of Biology of the Romanian Academy of Sciences, Cluj, Romania

[6] Taxonomic studies of *Cardaminopsis*, *Cardamine*, *Hieracium*, *Thymus*, *Hepaticae*, the endemic species of the Carpathians, 2002-2006

Material of the genera *Cardaminopsis* and *Cardamine* was collected throughout the Romanian Carpathians. Population samples for morphometric study, samples for AFLP analysis as well as seeds for karyological analysis were sampled. This material is being currently analyzed. Herbarium specimens of the genus *Cardaminopsis* in the main Romanian herbaria were studied.

➤ Komarov Institute of Botany, Russian Academy of Sciences, St. Petersburg, Russia

[7] Systematics and geography of selected taxa of Russia and Slovakia, 2000-2005

As part of this project the distribution and morphological variation of the species of the genera *Cardamine* and *Euphorbia* were studied in the herbaria of the Komarov Institute of Botany of the Russian Academy of Sciences and Institute of Botany S.A.S. Results of this study will be used in preparation of the monographic treatment of both these genera.

➤ Eötvös Lorand University, Faculty of Natural Sciences Budapest, Hungary

[8] Contribution to the life strategy of species *Colchicum autumnale* L., 2005-

Collaboration is aimed at structural and ultrastructural analyses of the species *Colchicum autumnale* L. during its developmental phases.

FRANKOVÁ L., **CIBÍROVÁ K.** - **BÓKA K.** - **GAŠPARÍKOVÁ O.** - **PŠENÁK M.** Protein reutilisation in corns of *Colchicum autumnale*. In *Biologia*. Vol. 61, no. 1 (2006), p. 97-102.

FRANKOVÁ L., **CIBÍROVÁ K.**, **BILKA F.**, **BALÁŽOVÁ A.**, **PŠENÁK M.** Nitrate reductase from the roots of *Colchicum autumnale* L. In *Acta Facultatis Pharmaceuticae Universitatis Comenianae*. Vol. 52 (2005), p. 98-107.

FRANKOVÁ L., **BÓKA K.**, **GAŠPARÍKOVÁ O.**, **PŠENÁK M.** Structural characteristics of the life strategy of *Colchicum autumnale* L. (*prepared for publication*)

➤ Institute of Ecology and Conservation Biology University of Vienna (IECB), Austria

[9] Macrophyte Inventory Danube/Corridor and Catchment (MIDCC). Macrophytes, River Corridor, Land Use, Habitats: A multifunctional study in the Danube catchment based on a GIS, 2002-2005

The field data on a survey of aquatic macrophytes in the Danube ox-bow lakes and in the Danube main stream, their habitat patterns and maps were acquired using identical standardized methodological approach. They were completed for the Annual Partner Reports and are available on web home page (www.midcc.at) together with reports from all Danube countries. The field data have been synthesized on aquatic macrophyte distribution and abundance in the river bed of Danube in Slovakia. The main biotope types in the recent Danube river bed have been characterized.

OŤAHEĽOVÁ H., VALACHOVIČ M. Distribution of macrophytes in different water-bodies (habitats) influenced by the Gabčíkovo hydropower station (Slovakia) – present status. Vol. 14, No. 1-2. In *Archiv für Hydrobiologie. Suppl. Large Rivers*. Vol. 147, no. 1-2 (2003), p. 97-115.

HRIVNÁK R., VALACHOVIČ M., RIPKA J. Relation between macrophyte vegetation and environmental condition in the Ipeľ River (Slovakia) - case study. In *Archiv für Hydrobiologie. Suppl. Large Rivers* 14. Vol. 147, no. 1-2 (2003), p. 117-127.

HRIVNÁK R., VALACHOVIČ M., RIPKA J. Ecological conditions in the Turiec River (Slovakia) and their influences on the distribution of aquatic macrophytes. In *Limnological Reports, Vol. 35, Proceedings of 35th IAD Conference, Novi Sad, Serbia and Montenegro*, 2004, p. 449-455.

OŤAHEĽOVÁ H., VALACHOVIČ M. Macrophytes of the River Danube, Slovakia. Partner Report - Multifunctional Integrated Study, Danube, Corridor and Catchment. 2004 (www.midcc.at)

OŤAHEĽOVÁ H., VALACHOVIČ M. Diversity of macrophytes in aquatic habitats of the Danube River (Bratislava region, Slovakia). In *Thaiszia - Journal of Botany*. Vol. 16, no. 1 (2006), p. 27-41.

[10] Plants from heavy metal-polluted habitats: specific plant communities and their structural and physiological adaptations, 2004- 2005

Heavy metal-rich localities, three in Austria and three in Slovakia, were compared with respect to both heavy metal content in the soil and occurrence of tolerant plants. Phytocoenological relevés were elaborated and structural and uptake/translocation/accumulation of metal ions were characterized in some tolerant species.

NADUBINSKÁ M., GRUBER D., HORAK O., LICHTSCHEIDL I., BANÁSOVÁ V., ČIAMPOROVÁ M. Plants from heavy metal- polluted habitats: How do they cope with increased zinc content? In *Plant Physiology Conference of PhD Students and Young Scientists, June 6 - 8th 2005. Book of abstracts*, Modra, Slovakia, 2005, p. 28.

NADUBINSKÁ M., BANÁSOVÁ V., HORAK O., ČIAMPOROVÁ M., GRUBER D., LICHTSCHEIDL I. Accumulation and intracellular localization of heavy metals in tolerant plants. In *XVII International Botanical Congress, Vienna, Austria, 17 - 23 July 2005, Abstracts*, 2005, p. 332. (poster)

BANÁSOVÁ V., HORÁK O., ČIAMPOROVÁ M., NADUBINSKÁ M., LICHTSCHEIDL I. K. The vegetation of metalliferous and non-metalliferous grasslands in two former mine regions in Central Slovakia. In *Biologia*. Vol. 61, no. 4 (2006), p. 433-439.

NADUBINSKÁ M., ČIAMPOROVÁ M., LICHTSCHEIDL I. Lokalizácia zinku v bunkách rastlín tolerujúcich ťažké kovy. In *Mikroskopie 2006, CSMS, Nové Město na Moravě, 16. -17. 2. 2006, Book of Abstracts*, 2006, p. 15.

- Universität Heidelberg, Heidelberger Institut für Pflanzenwissenschaften, Heidelberg, Germany
- Kobe University, Faculty of Science, Department of Biology, Kobe, Japan

[11] Population differentiation and phylogeographic distribution patterns of two selected polymorphic species groups: *Cardamine flexuosa*/C. *hirsuta* and *Cardaminopsis arenosa* agg. (*Brassicaceae*), 2004/2005

[12] Evolutionary phylogenetics and ecological genetics of the selected pan-Eurasian *Brassicaceae*, *Arabidopsis*, and *Cardamine*, 2004-2006

The cooperation dealt with the relationships of several species groups of the family *Brassicaceae*. Populations classified until now as *Cardamine flexuosa* in Europe, Asia and North America do not represent a single taxon. In fact this is a complex of several polyploid species of different origin. Using combination of various molecular markers, karyological and morphological methods we were able to clarify their origin. In the genus *Arabidopsis* (*Cardaminopsis*) we dealt with several species complexes occurring in both Carpathians and Alps. We have confirmed several diploid taxa at the level of subspecies within *Arabidopsis halleri*. These taxa are well differentiated both morphologically and genetically. The question of the occurrence of several annual species of the genus *Cardamine* in Japan has been solved. The problem of the nomenclatural type of the name *Arabidopsis kamchatica* has been clarified.

KOLNÍK M., **MARHOLD K.**, 2004: Morphological, karyological and molecular diversity of *Arabidopsis* (*Brassicaceae*) in the Carpathians and the Eastern Alps. – In: Anonymous, ed., XI OPTIMA Meeting / XIème Colloque d' OPTIMA, Abstracts / Resumes, 5.-11. IX, 2004, Beograd, p. 77, Beograd.

LIHOVÁ J., **KUDOH H.**, **MARHOLD K.**, **KOCH, M.A.**, 2006, Worldwide phylogeny and biogeography of *Cardamine flexuosa* (*Brassicaceae*) and its relatives. *Amer. J. Bot.* 93: 1206-1221.

KOLNÍK M., **MARHOLD K.**, 2006: Distribution, chromosome numbers and nomenclature conspect of *Arabidopsis halleri* (*Brassicaceae*) in the Carpathians. – *Biologia (Bratislava)* 61, p. 41-50.

LIHOVÁ J., **MARHOLD K.**, 2006: Phylogenetic and diversity patterns in *Cardamine* (*Brassicaceae*) – a genus with conspicuous polyploid and reticulate evolution. In: Sharma A. K., Sharma A. (eds.) *Plant genome: biodiversity and evolution*, vol. 1C: Phanerogams (Angiosperms – Dicotyledons). – Science Publishers, Inc., Enfield pp. 149-186.

MARHOLD K., **LIHOVÁ J.**, 2006: Polyploidy, hybridization and reticulate evolution: lessons from the *Brassicaceae*. – *Pl. Syst. Evol.* 259: 143-174.

KUDOH H., **MARHOLD K.**, **LIHOVÁ J.**, 2006: Notes on *Cardamine impatiens* L., *C. flexuosa* With., *C. hirsuta* L. and *C. parviflora* L. in Japan. – *Bunrui* 6: 41-49 (in Japanese with English summary).

SHIMIZU K. K., **FUJII S.**, **MARHOLD K.**, **WATANABE K.**, **KUDOH H.**, 2005: *Arabidopsis kamchatica* (Fisch. ex DC.) K. Shimizu & Kudoh and *A. kamchatica* subsp. *kawasakiana* (Makino) K. Shimizu & Kudoh, new combinations. – *Acta Phytotax. Geobot.* 56: 163-172.

- Real Jardín Botánico, Consejo Superior de Investigaciones Científicas, Madrid, Spain

[13] Comparative study of the genus *Cardamine* (*Brassicaceae*) in Central Europe and Iberian Peninsula, 2002-2003

Original and interesting results were obtained in characterising the *Cardamine pratensis* and *C. amara* groups in the Iberian Peninsula using cytological and molecular approaches and population analyses.

LIHOVÁ J., **MARHOLD K.**, **TRIBSCH A.**, **STUESSY T. F.**, 2004: Morphometric and AFLP re-evaluation of tetraploid *Cardamine amara* (*Brassicaceae*) in the Western Mediterranean. – *Syst. Bot.* 29: 134-146.

LIHOVÁ J., FUERTES AGUILAR J., MARHOLD K., NIETO FELINER, G., 2004: Origin of the disjunct tetraploid *Cardamine amporitana* (*Brassicaceae*) assessed with nuclear and chloroplast DNA sequence data. – Amer. J. Bot.

LIHOVÁ J., TRIBSCH A., MARHOLD K., 2003: The *Cardamine pratensis* (*Brassicaceae*) group in the Iberian Peninsula: taxonomy, polyploidy and distribution. – Taxon 52: 783-802.

➤ **Centro de Investigaciones Biológicas, Consejo Superior de Investigaciones Científicas, Madrid, Spain**

[14] Characterization of secretion pathway elements participating in plant cell wall modifications during the formation of tip-growing structures 2002 - 2003

Using cryotechniques for electron microscopy, the data on the mechanism of root hair initiation were obtained.

ČIAMPOROVÁ, M. - DEKÁNKOVÁ, K. - CORONADO, M. J. - OVEČKA M. - TESTILLANO, P. S., BALUŠKA, F. - RISUEÑO, M. C. Structural aspects of cell wall modifications during root hair initiation in *Vicia sativa*. In *Book of Abstracts, 6th Int. Symposium "Plant Root Development and Adaptation to Stresses"*, Stará Lesná, 2-6.9.2003, 2003, p. 14.

➤ **Instituto Tossine e Micotossine da parassiti Vegetali CNR, BARI, Italy**

[15] Toxicogenic fungi and their biocontrol, 2001-2003

The collaboration concerned potential plant protection agents against fusariosis.

ŠROBÁROVÁ, A. - NADUBINSKÁ, M. - EGED, Š. - ALTOMARE, C. - KOGAN, G. Treatment with ntagonist *Trichoderma* and cell-wall polysaccharides decreases maize root rot infestation by *F. verticillioides* and fusaric acid production. In *Book of Abstracts. XVI. Slovenská a Česká konferencia o ochrane rastlín, 16.-17.september 2003*, Nitra, p. 320.

ŠROBÁROVÁ, A. - KOGAN, G. - ALTOMARE, C. - MORETTI, A. The possibility of maize ear rot control by *Trichoderma* and fungal cell wall polysaccharide. In *Acta fytotechnica et zootechnica. Vol. 2* (2003), p. 50-52.

ŠROBAROVA, A. - KOGAN, G. - ALTOMARE, C. - MORETTI A. Fungal polysaccharide and *Trichoderma* as tools for maize ear and root rot control caused by *F. verticillioides*. In *Book of Abstracts, 5th International Symposium Recent Advances in Plant Biotechnology, Plant Biotechnology: Progress and Development. Stará Lesná, 2003*, p. 113.

➤ **Partner: Danish Cooperation for Environment in Eastern Europe (DANCEE)**

[16] Natura 2000 in Slovakia – bridging the implementation process, 2003–2004

Database of information on the areas included into the Natura 2000 network in Slovakia was considerably revised and supplemented. Basic information are summarised in the handbook „Biotopes with European significance in Slovakia “. The favourable conservation status of all habitats and organisms included into the European directives was defined and the methodology of its evaluation and classification was prepared. Management recommendations for securing or improvement of the favourable conservation status of all relevant habitats and organisms were proposed. The methodology of monitoring of habitats and species was prepared including concept of data collecting, storage and analysis.

M. VALACHOVIČ, I. JAROLÍMEK, H. OŤAHEĽOVÁ, M. ZALIBEROVÁ are the authors of contributions to the publication: VICENÍKOVÁ, A., POLÁK, P.(eds.) *Európsky významné biotopy na Slovensku*. [Biotopes with European significance in Slovakia], Banská Bystrica: ŠOP SR, 2003, 151 pp.

➤ Institute of Botany, Průhonice, Academy of Sciences of the Czech Republic

[17] Phytoplankton of the Slovak part of the Morava river, 2002-2005

[18] Phytoplankton of the Morava River, 2006-2008

[19] Cyanobacteria, Algae, Fungi, Bryophytes, 2002-2003

[20] Research on the flora of the Czech Republic and Slovakia, 1999-2003

[21] Diversity of the flora Slovak Republic and Czech Republic - vascular plants, 2002-2003

[22] Plants of Slovak and Czech Republic, 2004-2005

[23] Diversity of flora of Slovak Republic and Czech Republic II – vascular and non vascular plants, 2006 –2007

Biodiversity of the Czech Republic and Slovakia has been investigated: cyanophytes/cyanobacteria, algae, lichen, and vascular plant flora and diversity in selected territories as well as the herbarium material of vascular plants from several herbaria in the Czech Republic and from regional herbaria in both countries were studied. Most of the studies have dealt with the taxa continually elaborated and incorporated into the work Flora of Slovakia („Flóra Slovenska“).

ADAMČÍK, S. - RIPKOVÁ, S. First record of a *Pseudobaeospora* species from the Czech Republic. In *Czech Mycology*. Vol. 56, no. 3-4 (2004), p. 239-246.

BIELCZYK, U. - LACKOVIČOVÁ, A. - FARKAS, E. - LÖKÖS, L. - LIŠKA, J. - BREUSS, O. - KONDRATYUK, S. YA. Checklist of lichens of the Western Carpathians. Kraków: Inst. Botaniki im. Szafera PAN, 2003, 184 pp.

BERNÁTOVÁ, D. - GOLIAŠOVÁ, K. - KLIMENT, J. - MRÁZ, P. - ŠÍPOŠOVÁ, H. - UHLÍŘOVÁ, J. Taxóny vyšších rastlín, ktoré boli opísané z Veľkej Fatry (1. časť). [Vascular plant taxa described from Veľká Fatra Mts (1st part)]. In *Turiec a Fatra*. Turiec: SOP SR, Správa NP Veľká Fatra, 2004, p. 77-85.

GOLIAŠOVÁ, K. - MICHALKOVÁ, E.(eds.) *Flóra Slovenska V/3*. [Flora of Slovakia. Vol. V/3]. Bratislava: Veda, 2006, 343 pp. ISBN 80-224-0922-7.

GOLIAŠOVÁ, K. Rosaceae (*Agrimonia – Fragaria*). In KURTO, A. et al.(eds.) *Atlas Florae Europaeae 12*, Helsinki, 2004. (53 máp a komentárov z územia Slovenska). ISBN 951-9108-14-9

GUTTOVÁ, A. - PALICE, Z. Lišajníky Národného parku Muránska planina III- Cigánka. [Lichens from the National Park Muránska Planina III- Cigánka]. In *Reussia*. Vol. 1, Suppl. 1 (2004), p. 11-47.

HINDÁK, F. Three planktonic cyanophytes producing water blooms in Western Slovakia. In *Czech Phycology*. Vol. 6 (2006), p. 59-67.

HINDÁK, F. - HINDÁKOVÁ, A. Diverzita fytoplanktónu rieky Moravy a Dunaja v Bratislave r. 2003. [Phytoplankton diversity in the rivers Morava and Danube in Bratislava in 2003]. In *Bulletin Slovenskej botanickej spoločnosti*. Vol. 26 (2004), p. 9-17.

HINDÁK, F. - HINDÁKOVÁ, A. - MARVAN, P. - HETEŠA, J. - HAŠLER, P. Diversity, abundance and volume biomass of the phytoplankton of the Morava River (Czech Republic, Slovakia) and the Dyje River (Czech Republic) in November 2005. In *Czech Phycology*. Vol. 6 (2006), p. 77-97.

HINDÁK, F. - ŠMARDA, J. - KOMÁREK, J. *Nodularia moravica*, a new benthic nostocalean species. In *Archiv für Hydrobiologie. Algological Studies, Stuttgart*. Vol. 109 (2003), p. 241-254.

HODÁLOVÁ, I. - KOCHJAROVÁ, J. Chromosome numbers and pollen fertility in the *Senecio nemorensis* group (Compositae) in the Carpathians. In *Biologia*. Vol. 61, no. 1 (2006), p. 37-40.

LACKOVIČOVÁ, A. - PIŠÚT, I. Lišajníky Národnej prírodnej rezervácie Dobročský prales (Klenovský Vepor, Veporské vrchy). [Lichens in the National Nature Reserve Dobročský prales promarz forest (Klenovský Vepor, Veporské vrchy Mts)]. In *Bulletin Slovenskej botanickej spoločnosti*. Vol. 26 (2004), p. 23-30.

MARHOLD, K. - GRULICH, V. - HODÁLOVÁ, I. Taxonomy and nomenclature of *Senecio paludosus* (Compositae) in Europe. In *Annales Botanici Fennici*. Vol. 40 (2003), p. 373-379.

MARVAN, P. - HETEŠA, J. - HINDÁK, F. - HINDÁKOVÁ, A. Phytoplankton of the Morava river (Czech Republic, Slovakia): past and present. In *Oceanological and Hydrobiological Studies, Gdansk*. Vol. 33, no. 4 (2004), p. 42-60.

MICHALKOVÁ, E. Chromosome numbers of the *Erysimum diffusum* group (Brassicaceae) in Slovakia in relation to the Pannonian region. In *Biologia*. Vol. 60, no. 4 (2005), p. 377-381.

MRÁZ, P. - MRÁZOVÁ, V. (eds.) Flóra Volovských vrchov a príľahlej časti Braniska, Čiernej hory a Hornádskej kotliny [Flora of the Volovské vrchy Mts and adjacent parts of the Branisko Mts, Čierna hora Mts and Hornádska kotlina basin]. In *Bulletin Slovenskej botanickej spoločnosti*. Vol. 25, Suppl. 9, 2003 /Zprávy České botanickej spoločnosti. Vol. 38, Příloha 2003/, p. 1-76.

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ROTREKLOVÁ, O. - KRAHULCOVÁ, A. - MRÁZ, P. - MRÁZOVÁ, V. - MARTONFIOVÁ, L. - PECKERT, T. - ŠINGLIAROVÁ, B. Chromosome numbers and breeding system of some European species of *Hieracium* subg. *Pilosella*. In *Preslia*. Vol. 77, no. 2 (2005), p.177-195.

ŠIPOŠOVÁ, H. - BERNÁTOVÁ, D. - GOLIAŠOVÁ, K. - KLIMENT, J. - MRÁZ, P. - PENIAŠTEKOVÁ, M. Taxóny vyšších rastlín, ktoré boli opísané z Nízkyh Tatier (1. časť) [Vascular plant taxa described from Nízke Tatry Mts (1st Part)]. In *Príroda Nízkyh Tatier*. Banská Bystrica, 1, 2004, p. 191-197.

[24] **Plant communities of Korean Peninsula: first vegetation synthesis of poorly known territory**

Vegetation diversity of forests in northern part of Korean Peninsula was evaluated by numerical syntaxonomy methods and compared with relevant types of vegetation in surrounding countries. In close cooperation of the Slovak, Czech, Russian (Siberian), South Korean, Japan, Chinese and North American experts the monograph on forest vegetation of Northeast Asia was published. Several new vegetation units at the level alliance, association and subassociation were described.

KOLBEK, J. - JAROLÍMEK, I. - VALACHOVIČ, M. Forest vegetation of Northern Korean Peninsula. In KOLBEK, J. et al.(eds.) *Forest vegetation of Northeast Asia*. Geobotany 28. Dordrecht, Boston, London: Kluwer Academic Publisher, 2003, p. 263-361.

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C. Collective memberships in the international research organization

International Association for Plant Taxonomy – Institute of Botany is a collective/institutional member, within this association P. Lizoň is a member of the Committee for Fungi.

D. Document of international importance

MEMORANDUM OF COLLABORATION

BETWEEN INSTITUTE OF BOTANY, SLOVAK ACADEMY OF SCIENCES

AND THE BOARD OF TRUSTEES OF THE ROYAL BOTANIC GARDENS, KEW, UNITED KINGDOM

Memorandum of collaboration between the Institute of Botany, Slovak Academy of Sciences and the Board of Trustees of the Royal Botanic Gardens, Kew, United Kingdom, signed in December

2006, opens new possibilities of cooperation between these two institutions. The Royal Botanic Gardens in Kew is one of the world largest and most important institutions in biodiversity research, not only because of its extensive herbarium collections and libraries, but especially because of its excellent research studies in biodiversity from the molecular level to ecosystems. The Memorandum envisages exchange of data, plant material and cooperation in a wide spectrum of biodiversity studies.

Coordinator for the Institute of Botany: **K. Marhold**

ii. List of international conferences (co-) organised by the Organisation

- [1] 6th International Symposium "Structure and Function of Roots, Plant Root Development and Adaptation to Stresses", Stará Lesná, 2-6.9.2003
- [2] 21st European Cortinarius Foray (21. dni Európskej asociácie pre pavučinovce), Pribylina – Podbanské, SR, 28. 9.- 4. 10. 2003
- [3] 14th Congress of European Mycologists, Katsiveli, Ukrajina, 22.-27. 9. 2003.
- [4] Floristický kurz Pruské a jeho okolie, Pruské, 29.6. – 5.7.2003
- [5] Field workshop to heavy metal-contaminated localities in Slovakia in partnership with Institut für Ökologie und Naturschutz Universität Wien, 6.–8. 8. 2003
- [6] VIth International Conference on Anthropisation and environment of rural settlements. Flora and vegetation. Danišovce 2004.
- [7] Xth Days of Plant Physiology, 5.-9. 9. 2004, Bratislava, Slovakia
- [8] Measurement Uncertainty Macrophytes Workshop CEN TC 230/WG2 Biological and Ecological Assessment Methods. 10-11.6.2004
- [9] 12. Pracovné stretnutie slovenských a českých mykológov. 18.-20. júna 2004, Svätý Jur, Slovakia
- [10] Interreg IIIB Cadses-SIMOCA Project : WP2 – Transnational Workshop n° 3, Nitra, Slovakia, 29 - 30.3. 2004.
- [11] International Conference Lichen Diversity – knowledge, changes and trends. Bratislava, 10. 3. 2005
- [12] 9th Mycological Foray in Slovakia & International conference Mycoflora of the Western Carpathians, Pružina – Podskalie, 4. – 9. 10. 2005
- [13] VIIth International conference on Anthropization and environment of rural settlements. Flora and vegetation. Tarcas, Hungary, 2006.
- [14] National Nature Reserve Devínska Kobyla near Bratislava (Slovakia). XVII International Botanical Congress. Vienna, Austria, 17. 7. 2005
- [15] Xerotherm vegetation in Central Europe. Changes in vegetation. 3th Seminar of Departments of Geobotany in Skalce, ČR, 13-17.6.2005
- [16] 1st International Conference Traditional Agroecosystems, Satellite Workshop II. Threatened weedy plant species, Nitra, Slovakia, 2005
- [17] Plant Physiology Conference of young scientist and PhD students, Modra, 6-8.6.2005
- [18] 14th Annual workshop of Slovak and Czech Mycologists, Moravský Svätý Ján, 23.-25. 6. 2006.
- [19] International mycological workshop in Slovakia. Štiavnické vrchy, Nízke Tatry, 5.-13. 9. 2006.
- [20] Field workshop to heavy metal-contaminated localities in Slovakia. Central Slovakia (Banská Štiavnica, Banská Bystrica), 7. – 9. 6. 2006

iii. List of international journals edited/published by the Organisation

- [1] **Mycotaxon** (2001 – 2003)
 [2] **Biologia**, Section Botany

iv. List of edited proceedings from international scientific conferences and other proceedings

- [1] **HINDÁK, F., COESEL, P. F. M., SLUIMAN, H. J.** (eds) Proceedings of the 4th International Symposium Biology and Taxonomy of Green Algae, Smolenice, Slovakia, June 24-28, 2002. *Biologia*. Vol. **58**, 2003, p. 415-727.
- [2] **KOLBEK, J. - VALACHOVIČ, M.** (eds) Vegetační výzkum a mapování regionů. Hranice v geobotanice [Vegetation Research and Mapping. The Limits in Geobotany]. Proc. 1st International Seminar of Czech and Slovak geobotanists. Slovenská botanická spoločnosť, Bratislava, 2004. Bulletin Slovenskej botanickej spoločnosti. Supplement 11. ISBN 80-901151-9-5. 234 s.
- [3] **KOLBEK, J. - VALACHOVIČ, M.** (eds.) Xerothermni vegetace stredoevropského prostoru. Změny ve vegetaci. [Xerotherm Vegetation in the Central-European Area. Changes in the Vegetation] Referáty z 3. česko-slovenského geobotanického semináře, Skalice u Litoměřice, České středohorí, 13.-17. 6. 2005, Bratislava: SBS, 2006. Bulletin Slovenskej botanickej spoločnosti. Vol. 28, Supplement 2 (14), 2006, 152 s. ISBN 80-969265-4-3.

- **National position of the Organisation**

- i. **List of selected most important national projects (Centres of Excellence, National Reference Laboratories, Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA), and others)**

- ❖ **Agency for the Promotion of Research and Development (APVV/APVT)**

- [1] **Biodiversity of the phytoplankton of the Danube river and its main tributaries in Slovakia, 2002-2005**
APVT-51-009102

In the diversity database more than 1,100 species of cyanobacteria and algae are registered of these rivers. It can be said that thanks to this project the Slovak stretch of the Danube belongs to the best investigated part of the river at least from the phytoplankton point of view.

Phycological material obtained has been used for a monograph *Atlas of Euglenophytes and Chlorococcal Algae (Chlorophyceae)*. Besides, 2 papers in CC journal and 12 papers in non-CC journals were published, and 13 lectures were presented at symposia and conferences. Partial and final conclusions from our studies were referred at limnological and phycological seminars or hydrobiological courses for water managements and public-health authorities.

In co-operation with our Hungarian colleagues from the Danube Research Station at Göd, the epilithic algae and cyanobacteria in the Danube River from Ingolstadt (Germany) to Mohács

(Hungary) were studied. The main abundant group was diatoms, while chlorophytes formed about 20%. The water quality of the German-Austrian-Slovak parts of the Danube is generally good, mesotrophic, whereas Hungarian part and the rivers Morava, Váh, Hron and Ipel' moderate, eutrophic.

Investigations of the phytoplankton of the Morava River since the late 1950s show that water quality has been increased, nevertheless the river has still eutrophic status. This is mainly due to the Dyje River with three shallow reservoirs at Nové Mlýny in which a heavy cyanobacterial water bloom is produced in summer. These blooms influence a water quality not only in the Morava, but also in the Danube. Within 15 years of investigations, 634 species were determined, pertaining to 25 genera of cyanobacteria and 181 of different groups of algae. The highest value of cells were about 100,000 in 1 ml, and concentration of chlorophyll-a 100 µg/l. Together with our Moravian colleagues, phytoplankton qualitative and quantitative analyses from the upper, middle and lower stretches, and from the lowermost Dyje River were performed in autumn 2005. Altogether 346 species pertaining to 118 genera were determined, from which 18 species have not been registered in this river, and 1 species - *Koliella elongata* is the first record in Slovakia. In the Morava River the highest values were 29,317 cells in 1 ml, and the highest value of phytoplankton biomass was 16.0 mm³.l⁻¹. In the Dyje the respective values were 4,085 cells in 1 ml and biomass 2.4 mm³.l⁻¹.

F. Hindák, A. Hindáková

[2] Biosystematics of fungi described from Slovakia, 2002-2004

APVT-51-023902

Taxonomical studies on fungi described from Slovakia were accomplished. List of accepted names was prepared. Selected names, which are not in current use or with lacking types, were revised. Recent taxonomical treatment and nomenclature of taxa described by Kalchbrenner within the genera *Rhodocollybia*, *Hygrophorus* and *Pholiota* were determined. Most important result is, that neotype of *Rhodocollybia fodiens* is replaced by lectotype and a material collected on type locality is designated as epitype. Further taxonomical novelties are: *Agaricus decussatus* subsp. *illustris* is considered synonymous to *Pholiota lubrica*; *Agaricus punctulatus* is synonym of *Pholiota gummosa*. All four taxa of the genus *Pholiota* and three taxa of the genus *Hygrophorus* are typified by illustrations from original publication, eventually by material collected in area of type localities. Another taxa described from Slovakia were revised, e.g. from genera *Tricholoma* and *Mycena*.

New information for world-wide mycology is represented by results of studies on taxa related to *Russula xerampelina* occurring in alpine and arctic areas of Europe and Greenland. The delimitation of four accepted species is revised and new characters are established for its determination. Only one of the names used for taxa in recent literature is treated as correct: *R. pascua*. *R. nuoljae* is considered a dubious name. *R. chamitae* is synonym of *R. subrubens*. Two taxa formerly not known from arctic areas were discovered within material from Greenland: *R. clavipes* and *R. cicatricata*.

Important scientific result is description of two unknown morphotypes of *Pseudobaeospora* (Basidiomycetes). One of the taxa is described as a new for science *Pseudobaeospora basii* Adamčík & Ripková based on material from Slovakia.

P. Lizoň, S. Adamčík, V. Kučera

[3] Change dynamics in lichen diversity of Slovakia, 2002-2005

APVT-51-005102

A complex study of taxonomy, chorology and ecology of model lichen genera of the families *Lobariaceae*, *Collemaaceae*, *Gyalectaceae* and *Umbilicariaceae* contributed to clarification of

the process of changing the lichen diversity in Slovakia. Apart from the results significant for the scientific branch lichenology (species spectrum, variability and ecology), information applicable for public requirement were gathered. Current research of several regions of Slovakia as well as further European ones brought new knowledge on lichen diversity.

Tatry Mts.: the knowledge on the occurrence of lichens on the Slovak and Polish territory of the mountain region was monographed. 1309 lichen taxa and 80 taxa of lichenicolous fungi were recorded here, what is notable is the high number of epiphytes (326 species). The records gained exceptional importance for monitoring of evolution dynamics of lichen flora after heavy wind storm, which destroyed majority of the forest in Tatry Mts in November 2004.

Further large scale protected areas of Slovakia: new entries on components of lichen flora of Veľká Fatra Mts. (altogether 380 taxa), Strážovské vrchy Mts. (350 taxa), Kysucká vrchovina Mts. (156 taxa), Zoborské vrchy Mts. (169 taxa) were collected; an analysis of lichen diversity of eight primeval forests in Slovakia was completed.

Eastern and Western Carpathians: 2 extensive syntheses of the knowledge on Carpathian lichens were realized and published. In total, 1304 taxa of lichenized and lichenicolous fungi, 292 genera and 355 relevant bibliographic entries were recorded on the territory of 4 Eastern Carpathian countries. From the territory of Western Carpathians (Austria, the Czech Republic, Slovakia, Hungary and Poland), 1815 lichen taxa, 287 genera and 1245 bibliographic entries were collected.

The above mentioned monographs demonstrate the distribution of lichens in particular regions of the Carpathians and significantly contribute to the knowledge of the total biodiversity of European continent. They make easy to approach the scientific information also for scientific audience, however at the same time they point at unequal degree of recent knowledge of lichenized fungi in the second most important mountain range in Europe.

A. Lackovičová, A. Guttová, E. Lisická

[4] Impact of changes in air quality of urban agglomeration Bratislava on lichens, 2006-2009 **APVV-51-040805**

An extensive synthesis of our knowledge on lichens of Central Europe, being a result of cooperation between leading lichenologists from seven European countries was collected in the publication *Central European lichens – diversity and threat*. The book is devoted to lichen diversity in its broadest sense, to their threat and conservation aspects. It brings a large scale of new data on the distribution of interesting species in Central European countries (or selected areas within them), on changes in lichen diversity composition and on occurrence of rare and endangered lichens in time scale (Czech Republic, Slovakia, Central Poland), on ecology and taxonomy of selected species. The monograph significantly contributes to the knowledge on overall biodiversity of the European continent, and lichens in the Carpathian ecoregion.

Elaboration of the worldwide distribution of 38 taxa of the genus *Lecidea* occurring in Europe and of the identification key for European cetrarioid lichens is of global importance. The results crucial for lichenology involve new knowledge on taxonomy (justification of distinguishing the taxon *Solenopsorra carpatica* from *S. candicans* and *S. cesatii* var. *cesatii*) and in ecology of aquatic and toxitolerant lichens. Additional data on distribution of *Lepraria* and *Rinodina* species on the territory of Czech Republic, the genera *Physcia* and *Physconia* in Austria, and the lichen *Leucocarpia biatorella* in southern Poland are important for understanding the overall European distribution area of these taxa. Apart from its scientific importance, the book is valuable for practical application, mainly by the state nature conservancy bodies as lichens are often utilized as bioindicators of the environment quality.

A. Lackovičová, A. Guttová, E. Lisická

[5] Diversity of the flora of Slovakia with special attention to the trees 2002-2006
APVT-51-000702

The infrageneric diversity of the genera *Alnus*, *Betula*, *Broussonetia*, *Cannabis*, *Carpinus*, *Carya*, *Castanea*, *Celtis*, *Corylus*, *Fagus*, *Ficus*, *Hamamelis*, *Humulus*, *Juglans*, *Maclura*, *Morus*, *Ostrya*, *Parietaria*, *Platanus*, *Populus*, *Pterocarya*, *Quercus*, *Salix*, *Ulmus*, *Urtica* and *Zelkova* was evaluated. The diversity of native species and cultivars of cultivated taxa was assessed, too. The project represents the basic taxonomical and chorological study of all native, introduced, cultivated, casual aliens and expected taxa of the orders *Hamamelidales*, *Urticales*, *Fagales*, *Juglandales* and *Salicales* in Slovakia. These orders include many trees important for forestry. The chromosome numbers of *Urtica dioica*, *U. kioviensis* and *Cannabis ruderalis* were analysed. Taxonomical and nomenclatural problems of selected taxa of genera *Quercus*, *Urtica*, *Betula*, *Alnus* and *Corylus* were solved. The new identification keys, descriptions and actual distributions of native taxa in Slovakia were elaborated. The northern distribution limit of some thermophilous taxa (e. g., *Quercus cerris*, *Q. dalechampii*, *Q. pedunculiflora*, *Q. frainetto*) in Slovakia was identified. The study of the most significant woody species, namely *Alnus glutinosa*, *Populus alba*, *P. nigra*, *Quercus robur*, *Q. petraea*, *Q. cerris*, and *Ulmus laevis* on important dendrological localities in Eastern Slovakia and the biological study of *Morus nigra* in the vicinity of Pukanec (Central Slovakia) were carried out. The volume VI/3 of the Flora of Slovakia treating orders *Hamamelidales*, *Urticales*, *Fagales*, *Juglandales* and *Salicales* was published. It includes original drawings of plants, grid maps, general distribution maps, and identification keys in English.

K. Goliašová, T. Miháliková, E. Michalková, M. Peniašteková, H. Šípošová, O. Ťavoda

[6] Ferns and flowering plants described from the territory of Slovakia, 2002-2005
APVT-51-009202

Slovakia is an important territory of the Carpathian and Pannonian region. Many taxa of ferns and flowering plants of various ranks (incl. infraspecific taxa, hybrids etc.) were described from this area. The project resulted in:

1. Electronic checklist of taxa described from Slovakia (approx. 2040 taxa, deposited in the Institute of Botany SAS, Bratislava)
2. Electronic and literature documentation for every taxon (deposited in the Institute of Botany SAS, Bratislava)
3. Digital documentation of type material from the territory of Slovakia (available material from the herbaria in the Slovak Republic, Czech Republic, Hungary; deposited in the Institute of Botany SAS, Bratislava)
4. Documentation of the type material from Veľká Fatra National Park and Nízke Tatry National Park was published.

H. Šípošová, K. Goliašová, M. Peniašteková, P. Mráz

[7] Chromosome numbers survey of the ferns and flowering plants of Slovakia, 2002-2005
APVT-51-006002

The main output of the project is the final version of the manuscript: *Chromosome numbers survey of the ferns and flowering plants of Slovakia* that will be published by VEDA, the publisher of the Slovak Academy of Sciences in 2007. This book, apart from the printed version in English, will include also CD in Slovak and English with complete database of the karyological data. The survey of chromosome numbers contains 7661 records on 3001 taxa of pteridophytes and flowering plants of Slovakia up to the end of 2006. Out of them 119 records are new, published for the first time in this book, and further 368 records were taken from unpublished manuscripts (mostly diploma and PhD theses). All data included in the database were subjected to revision by more than 50 experts from Slovakia, Czech Republic and Austria.

The content of the book and the included CD are available also on-line at <http://147.213.100.144/webapp/>. In addition, we studied in detail several groups of plants and acquired a lot of new valuable data. They were published either in separate papers or included in the above-mentioned book, CD and database.

K. Marhold, P. Mered'a, P. Mráz, I. Hodálová, M. Kolník, J. Kučera, J. Lihová, M. Perný, I. Valko

[8] Identification key of ferns and flowering plants of Slovakia and solving the problems of critical species groups in a Central European area, 2005-2007

APVT-51-026404

Manuscript on about 950 genera has been completed for the Identification key of ferns and flowering plants of Slovakia, and will be prepared for publication by the end of 2007. The identification key will represent the first publication of this kind for the territory of Slovakia and will serve as an important manual for all those who deal with plants in the field, namely for taxonomists, ecologists, foresters, and for the purposes of plant conservation. The revision of existing lists of diagnostic taxa of higher syntaxa of plant communities of Slovakia using a representative set of phytosociological data and standard statistical approach is in a good progress. Identification of diagnostic species will result in a separate publication. This information, however, will also be incorporated into the identification key, bearing in mind that the information on coenological affinity is often helpful as additional information for identification of plants. Several species groups of the genera *Viola*, *Onosma*, *Hieracium*, *Pilosella* and *Cardamine* are studied in detail using combination of morphometric and genetic methods. For this purpose laboratory of molecular systematics was established in 2005 where DNA sequences, AFLP, and PCR-RFLP analyses are carried out.

K. Marhold, I. Hodálová, J. Lihová, P. Mered'a, V. Feráková, M. Perný, M. Kolník, J. Kučera, M. Slovák, I. Jarolímek, M. Valachovič, K. Hegedúšová, I. Škodová, B. Šingliarová, R. Letz

[9] Time course and localisation of stress proteins induced by abiotic stresses in plants, 2002-2005

APVT 51-001002

Rapid response of plant cells to stress induced by toxic concentrations of metals (Al, Cd, Co, Cu), drought, and salinity. As soon as during germination, the individual stress factors induced changes in the activity of several antioxidant as well as hydrolytic enzymes, in the composition of extra- and intracellular proteins. Stress-induced enhanced production of reactive oxygen species has revealed to be substantially responsible for dieback of root epidermal cells, and the damaging formation of lesions on the root surface.

I. Mistrík, L. Tamás, M. Ollé, B. Bočová, J. Huttová

[10] Formalized classification system for identification of grassland vegetation, 2005-2007

APVT 51-015804

The Slovak phytosociological database of grassland vegetation was extended by all individual unpublished relevés from insufficiently known regions (1500), unpublished relevés gained from external sources (2000), and recently compiled published relevés (2500). In addition, the geographical position of 3000 relevés was included. Recently, the database contains 11 121 relevés of grassland vegetation. The header data of relevés were inspected and the nomenclature of taxa was unified. The subxerophilous grassland vegetation dominated by *Brachypodium pinnatum* and *Bromus erectus* was analyzed in the Central European region. A new method of cross-validation was proposed aimed at testing of clusters validity in classification results. Four studies of local grassland vegetation were prepared.

M. Janišová, I. Škodová, K. Hegedúšová, L.

❖ Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA)

[1] Flora of cyanobacteria and algae of thermal springs in Slovakia, 2004-2006

VEGA 2/4033/24

During our studies of thermophilic phototrophic microorganisms in thermal waters of Slovakia, 21 genera with 20 infrageneric taxa of Cyanobacteria and 43 genera with 217 species and varieties were determined in Piešťany and 28 genera with 30 species of Cyanobacteria and 19 genera with 83 species and infraspecific taxa of diatoms (Bacillariophyceae) in Sklené Teplice. From Piešťany 7 taxa of diatoms are new for the algal flora of Slovakia, i.e. *Gomphonema grovei* var. *lingulatum*, *G. insigne*, *Navicula sublucidula*, *Nitzschia amphibia* var. *frauenfeldii*, *N. desertorum*, *N. vitrea* var. *salinarum* and *Surirella terricola* (Hindák & Hindáková; 2006). From Sklené Teplice 8 species of Cyanobacteria are new records to the algological flora of Slovakia, i.e. *Cyanobium parvum*, *Gloeothece palea*, *Geitlerinema thermale*, *Leptolyngbya ferruginea*, *Leibleinia epiphytica*, *Lyngbya thermalis*, *Microcoleus steenstrupii*, *Scytonema stuposum*. The life cycle of a rare nostocalean species *Chlorogloeopsis fritschii* was studied in cultures isolated from fields in India (type locality), thermal springs in Slovakia and a saline lake in Tunisia. Similarly as in the genera *Nostoc*, *Trichormus* or *Nodularia*, in *C. fritschii* all vegetative cells were able to transform into akinetes. The akinetes divided asymmetrically into a smaller part to be transformed into a heterocyte, and a bigger one, which divided again into two equal parts as vegetative cells, what is unique in this group of cyanobacteria.

F. Hindák, A. Hindáková

[2] Diversity of phytopathogenic micromycetes and their host plants in biospheric reserve Tatra National Park, 2004-2006

VEGA 2/4032/24

Complex study of diversity, taxonomy, chorology and ecology of phytopathogenic fungi and their host plants was carried out in the International Biosphere Reserve Tatra National Park. Historical knowledge and new information on distribution of 310 taxa and 21 infraspecific taxa of phytopathogenic fungi Peronosporales (Oomycota), Protomycetales, Taphrinales, Erysiphales, Sphaeriales (Ascomycota), Uredinales, Ustilaginales (Basidiomycota) and Mitosporic fungi were collected, deposited in the mycological herbarium (SAV) and recorded in an electronic database. The list of fungi, their hosts, and an actual state of diversity of was prepared. In the natural ecosystems of plant communities 25 new species for Biospheric Reserve Tatra National Park (e.g. *Plasmopara praetermissa*, *Spermospolina gymnadeniae*, *Microbotryum pinquiculae*, *Protomycopsis arnoldii*, *Protomyces crepidis-paludosae*), 19 species of the genus *Ramularia* were found. The taxon *Pseudocercospora tatrensis* sp. nov. Mullenko & Bacigálová, was described as new for science. The first list of species and bibliography of Taphrinomycetes and their host plants referring to International Biospheric Reserve area (Polish and Slovakian) was published. New information for the European mycoflora is the first finds of invasive phytopathogenic species in the Carpathian and Slovak territories (e.g. *Melampsorium hiratsukanum*, *Erysiphe azalea*, *Phyllactinia corni*), and taxonomical knowledge on rare species of fungi and their hosts in European area (e.g. *Vankya vaillantii*, *Protomyces cirsii oleracei*, *Erysiphe azalea*, *Septoria mori*) was extended.

K. Bacigálová, E. Záletová

[3] Mycological research of non-forest habitats in Slovakia, 2004-2006

VEGA No 2/4031/24

The genera *Entoloma*, *Clavaria*, *Ramariopsis*, *Hygrocybe*, *Pseudobaeospora*, *Trichoglossum* a *Camarophylloopsis*, which contain species important as indicators of natural value of non-forest habitats were studied. *Pseudobaeospora celluloderma* was reported from area of Slovakia for the first time. The knowledge of variability and distribution of the related species *P. mutabilis* and *P. basii* was extended and determination key of the species of this group was prepared. Endangered species *Gymnopilus fulgens* and *Bovista paludosa* were reported on new sites in the Laborecká vrchovina Mts. The herbarium material collected in Cerová vrchovina Mts., Laborecká vrchovina Mts., Spišská kotlina basin, Slovenské rudohorie Mts. and Biele Karpaty Mts. was classified and identified. Indicator species of natural value of grasslands were selected and first evaluations of the studied biotops were prepared based on the occurrence of the fungi.

S. Adamčík, P. Lizoň, V. Kučera

**[4] Characterization of lichen-diversity within selected biocenters in Slovakia, 2004-2006
VEGA 2/4035/24**

The project was aimed to comprehend the original scientific knowledge on character of epiphytic lichen diversity of oak forests in the selected biocentres and adjacent bioareas within the eight orographical units in Slovakia. The relevés of frequencies of epiphytic lichens were sampled allowing for identification of components of epiphytic lichen diversity. Based on the relevés the values of Lichen Diversity Value indices were calculated for the particular study areas. An interpretation scale for the indices was elaborated, for the first time in Slovakia, to classify the studied oak forests. The scale enables to identify the level of deviation of lichen diversity from the natural status within the area. The results show that the boundary values of the scale are comparable with the scales established for industrial or urban areas of the countries of Western and Southern Europe, where the method is being actively used. The following classes of environmental alteration were attributed to the studied areas: very high, high, moderate, low, negligible. Based on the acquired data, the studied sites are assigned as natural, semi-natural, semi-altered and altered in the Malé Karpaty Mts., natural, semi-natural and semi-altered in the Strážovské vrchy Mts. In the Považský Inovec Mts. the studied sites fall within the categories of natural and semi-natural environment, in the Muránska planina Mts. within semi-natural and semi-altered environment.

A. Guttová, A. Lackovičová, E. Lisická

**[5] Bryophytes (Hepatophyta, Anthocerotophyta, Bryophyta) and their coenoses in bryologically important habitats in Slovakia, 2004-2006
VEGA 2/4034/24**

Investigations in inland salt meadow communities of bryophytes and the communities in Pannonic inland dunes of the Podunajská nížina lowland and Hronská pahorkatina hills showed that the bryophyte diversity is richer in salt meadows than on inland dunes. The localities Bokrošské slanisko, Búčske slanisko and the salt meadow Derhídja with a steppe character, are significant for rare, halophytic bryophyte species e.g. *Enthosodon hungaricus*. The output of the research in glacial relic species in Slovakia is a summary of all the available data on *Helodium blandowii* and characterization of physico-chemical properties of ground- and day-water in its stands. Bryoflora of National Nature Reserve Dobročský prales was evaluated, comprising 61 taxa of bryophytes (15 liverworts and 46 mosses). The most valuable records are *Buxbaumia viridis* and *Neckera pennata*, which are redlisted in Slovakia. Research in agrocoenoses of the Protected Landscape Area Strážovské vrchy provided new knowledge in chorology of rare and protected species of bryophytes, eg. *Moerckia hibernica*, *Bryum turbinatum*, *Plagiomnium ellipticum*.

A. Kubinská, K. Kresáňová

[6] Taxonomic revision of the genus *Cardamine* s.l., 2003-2005

VEGA 2/3042

During the three-year-work on this project, our knowledge on the genus *Cardamine* was significantly extended. Several taxonomic problems have been elucidated, and understanding of evolutionary relationships within the genus has been largely improved. *Cardamine* can be considered as a model genus that enables studies on various aspects of polyploid evolution. Analyses of several taxa using combination of karyological, morphological and molecular methods revealed considerable amount of variation in the genus both at the diploid and polyploid levels. The extent of differentiation among the diploid taxa *C. impatiens* – *C. pectinata*, *C. maritima* – *C. rupestris* – *C. serbica* – *C. fialae* indicates preglacial origin of this variation. On the other hand, infraspecific variation in *C. acris* is undoubtedly of younger origin. Similarly, the origin or the distribution range of many taxa of the polyploid complexes *C. amara*, *C. raphanifolia* and *C. pratensis* can be dated to the time of Pleistocene migrations connected with the impact of glacial events on the European continent. Comparative studies on European, East Asian and North American populations of several species showed that many previous taxonomic conclusions were incorrect, apparently caused by the absence of comparative plant material from other parts of the distribution range. Different evolutionary history and hence the taxonomical identity of the European and East Asian populations originally classified as *C. flexuosa* enabled to explain their contrasting ecological affinities.

K. Marhold, J. Lihová, J. Kučera, M. Perný

[7] Diversity of herbaceous vegetation in synanthropic habitats of the Borská nížina lowland, 2001-2004

VEGA 2/2030/24

The first complete survey of non-forest plant communities of synanthropic habitats in the Borská nížina lowland based on a large set of both published and unpublished phytocoenological data was prepared. In total, 143 communities were found, 32 of them were newly recorded in the Borská nížina lowland, one of them, *Euphorbio cyparissiae-Callunetum* was described for the first time in Slovakia. Most of the newly recorded syntaxa belong to the segetal vegetation of the subclass *Violenea*. On the other hand, most of the nitrophilous ruderal communities of the alliance *Malvion neglectae* were not confirmed on this territory. Large areas are covered by nitrophilous tall-herb communities of the alliances *Galio-Alliarion* and *Senecionion fluviatilis* mainly on alluviums of the rivers Morava and Myjava, in the abandoned fields and clearings in pine forests. High occurrence of invasive neophytes is typical for these communities. The presence of rare and threatened species in all communities was also carefully studied. Most of these species occurred within the man-influenced wet meadow communities, and within the segetal communities. Distribution maps of threatened segetal species from the past (1950) and recent time were compared. Analyses of vegetation in the alluvium of the Morava river showed close relations among the ecotone vegetation, steepness of ecological gradients, and anthropogenic impact.

M. Zaliberová, V. Banášová, K. Hegedúšová, I. Jarolímek, H. O'ahel'ová, I. Škodová, M. Valachovič

[8] Classification and ecological differentiation of the mesophilous and xerophilous grassland communities in the Slovak part of Western Carpathians 2005-2007

VEGA 2/5084/25

The field phytosociological survey focused on selected regions of Slovakia and a substantial set of relevés was collected: Starohorské vrchy Mts. (320 relevés), Biele Karpaty Mts. (320 relevés), Poľana Mts. (670 relevés) and Javorie Mts. (70 relevés). The Slovak Central

Phytosociological Database was extended with both individual unpublished and accessible published relevés and recently it contains 7748 phytosociological relevés of mesophilous and xerophilous grassland vegetation. The numerical classification of relevés belonging to the class *Festuco-Brometea* was performed. It identified six main clusters at the alliance level.

Vegetation-environment relationships were studied on a transect in the Považský Inovec Mts. and the effect of grassland management on species diversity was studied in the Poľana Mts.

M. Janišová, I. Škodová, K. Hegedúšová, M. Zaliberová, D. Micháľková, J. Májeková

[9] Demecological, synecological and genetic aspects of the colonization of pastures by forest tree species, 2003-2005.

VEGA 2/0126/23

The effects of spruce colonization upon the understorey vegetation were studied along a transect in the locality Príslopy (Poľana Mts.). The mesotrophic and oligotrophic variants were distinguished within the identical spruce-beech succession series, which differed in both initial phase and course, but led to the same outcome phase. The detailed measurements of climatic, biological, pedological and soil-microbiological factors were performed along the transect. The variability of understorey vegetation was affected mainly by percentage cover of needles and plant litter along with the light availability. Relations between spruce fertility, seed rain, seedlings establishment and environmental variables were confirmed.

R. Hrivnák, M. Janišová

[10] Shrub and thicket formations, 2004-2006

VEGA 2/4041/24

The processes of succession and spontaneous invasion of shrubs and trees were studied on several transects and permanent plots. The first data were obtained and results were published from a locality in an inland sand dune pine forest near Malacky (Borská nížina lowland) and in co-operation (project VEGA No 0126) on transect Príslopy (Poľana Mts.). The spatial and temporal pattern relations between overstorey trees and understorey vegetation were studied as related to microhabitat data e.g. soil moisture, soil temperature, snow cover, distribution of lichens, dendrochronological data, and using air-photos, digital terrain model and GIS techniques.

Large amount of data (relevés) was added into the database and analysed using numerical classification. The mountain vegetation with dwarf pine (the class *Roso pendulinae-Pinetea mugo*) subalpine communities of deciduous shrubs (the class *Betulo carpaticae-Alnetea viridis*), and alpine heaths (the class *Loiseleurio-Vaccinieta*) was completely revised in the Western Carpathians. A conceptual scheme has been prepared for shrubs and thickets (the classes *Rhamno-Prunetea*, and *Franguletea*).

M. Valachovič, I. Jarolímek, R. Hrivnák, K. Hegedúšová, I. Škodová, and PhD students, J. Šibík, J. Sadloňová, M. Sádovský, B. Mikuška, A. Košuthová-Dingová

[11] The non-forest vegetation of the mountain and subalpine belts of the Krivánska Malá Fatra Mts, 2006-2008

VEGA 2/6057/26

Acidophilous communities of dwarf-shrub heaths dominated by ericaceous species (*Empetraceae*, *Ericaceae*, *Vacciniaceae*) of the Malá Fatra Mts was analysed and compared with similar vegetation within the Western Carpathians and published. Next volume of the edition Vegetation of Slovakia (4-th) dealing with high mountain vegetation was finished with support of this project. Relations between vegetation, relief, elevation and exposition were analysed on transect from montane to subalpine belt (700-1700 m n. m.). Digital model of the studied area is under preparation. One diploma and one PhD thesis were finished within the project.

I. Jarolímek, J. Šibík, I. Šibíková, M. Valachovič

[12] Plant communities of the Muránska Planina National Park. 1. Non-forest vegetation, 2003-2005

VEGA 1/0045/03

Plant communities with dominant species *Calamagrostis arundinacea*, *C. varia*, *Carex firma*, *C. humilis*, *Festuca pallens* and *F. tatrae* from the Muránska planina Mts and similar ones from Slovak (resp. Polish) part of the Western Carpathians within the large syntaxonomical revisions were compared. The association *Geranio robertiani-Delphinietum elati* Kliment et al. 2004, subassociations *Pulsatillo slavicae-Caricetum humilis campanuletosum xylocarpae* Uhlířová et Bernátová 2004 and *Minuartio langii-Festucetum pallentis campanuletosum xylocarpae* Kliment et al. 2005 based on relevés from the Muránska planina Mts were newly described. Riparian communities of the alliance *Petasition officinalis* were completely evaluated and classified.

Detailed characteristics of 30 macrophyte and wetland communities (*Lemnetea*: 2; *Potametea*: 8; *Phragmito-Magnocaricetea*: 20), found in course of the project, were published. The lists of plant communities, vascular plants, mosses and partially lichens were completed. The most interesting findings of the vascular plants and mosses and their coenological characteristics were also published. High floristic and vegetation (biotope) diversity was confirmed. Warning message on spreading of several invasive species (*Bunias orientalis*, *Juncus tenuis*) was highlighted.

A. Guttová, I. Jarolínek, M. Zaliberová, R. Hrivnák, M. Valachovič

[13] Metabolic and anatomical responses of the plants to water deficit, 2004-2006

VEGA 2/4036/26

Water deficit induced osmotically by a sorbitol solution (-1.4 MPa) reduced growth of two maize cultivars differing in water stress tolerance. The stress conditions induced lipid peroxidation, electrolyte leakage, decrease in respiration rate, accumulation of soluble saccharides. The responses depended on the tolerance of the cultivars.

M. Luxová, O. Gašparíková, P. Valentovič, L. Kolarovič

[14] Structural and functional effects of cadmium on plants, 2004-2006

VEGA 2/4040/26

Cadmium inhibited growth of barley roots, cell elongation, cell viability and activity of some hydrolytic enzymes. The responses at cellular level corresponded with H₂O₂ content and activity of oxalate oxidase in the root tissues. Cd induced activation of one anionic and two cationic peroxidases associated with microsomal fraction of the cells. In this fraction also an increased activity of NADH-oxidase and H₂O₂ production.

L. Tamás, J. Huttová, J. Dudíková, I. Mistrík, K. Ďurčková, P. Paľove-Balang

[15] Plants from heavy metal polluted habitats: their communities, structural and physiological adaptations, 2005-2007

VEGA 2/5086/25

The project combines diverse approaches to the study of heavy metal tolerance in wild plants growing in their natural habitats with contaminated soil. The floristic composition and structure of plant communities with "normal" or toxic concentrations of heavy metals (Zn, Pb, Cu, Cd) were compared in three former mining regions in Slovakia. They differed in number and composition of plant species, in the proportion of lichens (some of them being rare and threatened), and mosses, in dependence of the occurrence and amount of the metals. *Thlaspi caerulescens* from these localities was confirmed as Zn and Cd hyperaccumulator. Using

specific fluorescent staining, the accumulation of Zn was detected in the vacuoles of live cells in *T. caerulescens*, and *Arabidopsis halleri* leaves.

ii. List of national scientific conferences (co)-organised by the Organisation

- [1] Hydrobiologický kurz [Course on Hydrobiology], Modra-Harmónia, 26.-28.5.2003
- [2] Hydrobiologický kurz [Course on Hydrobiology], Bratislava 25. - 26. 5. 2004
- [3] Hydrobiologický kurz [Course on Hydrobiology], Bratislava, 3.-7.10.2005
- [4] Hydrobiologický kurz [Course on Hydrobiology], Bratislava, 15. - 18. 5. 2006
- [5] Konferencia o službe sprístupňujúcej slovenské biologické zbierky pre Európu [BioCASE Slovak National Meeting], Bratislava, 10.-11. 11. 2004
- [6] 8. Zjazd Slovenskej botanickej spoločnosti pri SAV [8th Congress of the Slovak Botanical Society SAS], 1.– 4. 6. 2004, Moravský Svätý Ján.

List of national scientific seminars and field work courses organised by the Organisation

- [1] Otvorenie lichenologického roka, Bratislava, Dubová, 10.-11. 4. 2003
- [2] Lichenologické vinobranie, Bratislava, Častá, 29.-30. 10. 2003, počet účastníkov: 11
- [3] Biodiverzita húb Slovenska 3, [Biodiversity of Fungi in Slovakia 3], Bratislava, 9. 12. 2003
- [4] Biodiverzita húb Slovenska 4 [Biodiversity of Fungi in Slovakia 4], Bratislava, 7. 12. 2004
- [5] Biodiverzita húb Slovenska 5 [Biodiversity of Fungi in Slovakia 5], Bratislava, 6. 12. 2005
- [6] Biodiverzita húb Slovenska 6 [Biodiversity of Fungi in Slovakia 6], Bratislava, 5. 12. 2006
- [7] Kolokvium o flóre Slovenska [Colloquium on the Flora of Slovakia] Bratislava 30.11.2005
- [8] Seminár Spomienkové popoludnie venované významným výročiam botanikov a botanického života na Slovensku [Seminar devoted to anniversaries of outstanding Slovak botanists], Bratislava, 13. 12. 2006

iii. List of national journals published by the Organisation

- [1] Bulletin Slovenskej Botanickej Spoločnosti
- [2] Catathelasma, Slovenská mykologická spoločnosť, Bratislava

iv. List of edited proceedings of national scientific conferences/events

- [1] none

• International/European position of the individual researchers

i. List of invited/keynote presentations at international conferences, documented by an invitation letter or programme

- [1] Hindák, F., 2004: Taxonomy and ecology of cyanobacteria. 3rd Summer Algological School, EAWAG ETH, Dübendorf, Switzerland, 27.9.-2.10. 2004.
- [2] Hindák, F., 2005: Observations on four coccoid soil or aerophilic rhodophytes. In: Kostikov, I., Algae in terrestrial ecosystems, Kaniv, Sept. 27-30, 2005.
- [3] Hindáková, A., Houk, V., 2006: Introduction to the freshwater diatoms. I. Centric diatoms. Int. workshop: Phytoplankton analyses in stagnant surface waters. 30.7.-6.8.2006, Bled

- [4] Hindák, F., Hindáková, A., 2006: Some examples of invasive/ expansive species of cyanobacteria and algae in Europe. Int. workshop: Phytoplankton analyses in stagnant surface waters. 30.7.-6.8.2006, Bled.
- [5] Hindák, F., Hindáková, A., 2006: Some examples for invasive behavior of cyanobacteria and algae from Slovakia. –25th Int. Phycol. Conf., Poznań, 16.-20. 5. 2006
- [6] Hindák, F., 2005: Conjugatophyceae. 15. Int. Summer Ecological School. Zaklad Hydrobiologii, Instytut Biologii Śródownska, Uniwersytet im. Adama Mickiewicza, Poznań, 23.-30.6.2005
- [7] Perný, M. - Hodálová, I. - Lihová, J. - Kolník, J. - Kučera, J. - Marhold, K. - Mártonfi, P. - Mereďa, P. - Mráz, P. Database of chromosome counts of Pteridophytes and flowering plants of the Slovak republic. XI Optima Meeting, Beograd, 5-11. IX.2004
- [8] Lihová, Judita - Marhold, Karol: *Cardamine pratensis* group in the Iberian and Apennine Peninsulas – taxonomic and evolutionary inferences. IXth IOPB Meeting, Valencia, 16-19.5.2004
- [9] Marhold, K., Lihová, J., 2005: Hybridization, reticulation and polyploidy in *Cardamine* and other *Brassicaceae* genera. In: Anonymous, ed., XVII International Botanical Congress, Vienna, Austria, 17.-23. June 2005
- [10] Mráz, P., Taberlet, P., Gielly, L., Chrtek, J.: Molecular phylogeography of the arctic-alpine species *Hieracium alpinum*. 9th International Hieracium Workshop Ljubljana, Slovenia 2006
- [11] Chrtek, J., Mráz, P.: *Hieracium* s.str. in the Western Carpathians. 9th International Hieracium Workshop, Ljubljana, Slovenia, 2006.
- [12] Šingliarová, B., Mráz, P., Chrtek, J. jun., Plačková, I.: *Pilosella alpicola* subsp. *ullepitschii*, a diploid endemic taxon of the Carpathians: notes on taxonomy, chorology and ploidy level. 9th International Hieracium Workshop, Ljubljana, Slovenia, 2006.
- [13] Urfus, T., Šingliarová, B., Mráz, P., Krahulec, F.: *Pilosella officinarum*: longitudinal differences in ploidy level distribution in the Czech Republic and Slovakia. 9th International Hieracium Workshop, Ljubljana, Slovenia, 2006.
- [14] Baluška, F.: Actin cytoskeleton in plants: from cell polarity towards cell-to-cell communication. Meeting of the Czech's Cytoskeletal Club, Vranovska Ves, Czech Republic (April 2003)
- [15] Baluška, F.: The root transition zone: postmitotic cells between meristem and elongation, SEB Meeting 2004, Edinburgh, UK (March/April 2004)
- [16] Baluška, F.: Cytoskeleton, myosin VIII and root cell polarity, University of Heidelberg, Heidelberg, Germany (March 2005)
- [17] Baluška, F.: Plant polarity: focus on vesicle recycling, plant synapses, and root apices, University of Tübingen, Tübingen, Germany (May 2006)
- [18] Baluška, F.: Signalling via endocytosis: from the cell wall up to the nucleus, University of Granada, Granada, Spain (April 2006)
- [19] Baluška, F.: From endocytic vesicle recycling to plant synapses, The 8th Assembly of Plant Molecular Biologists, Pamplona, Spain (June 2006)
- [20] Baluška, F.: Plant neurobiology: neurobiological view of plants, University of Osnabrück, 3. Westerberger Herbsttagung, Osnabrück (September 2006)
- [21] Ovečka M: Neinvázna mikroskopia dynamických procesov v rastlinnej bunke. [Non-invasive microscopy of the dynamic processes in plant cells]. Seminár Československej Mikroskopickéj Spoločnosti (CSMS), Bratislava, 25.11. 2005

- [22] Ovečka M, Lichtscheidl IK, Baluška F: Jednoduchá mikroskopická analýza niektorých dynamických procesov v rastlinných bunkách. [Simple microscopic analysis of some dynamic processes in plant cells]. Výročná konferencia CSMS Mikroskopie 2006, Nové Město na Moravě, 16-17.2.2006.
- [23] Ovečka M, Baluška F, Lichtscheidl IK: Non-invasive microscopy of tip growing root hairs as a tool for study of dynamic, cytoskeleton-based processes. Book of abstracts, The Plant Cytoskeleton: Genomic and Bioinformatic Tools for Biotechnology and Agriculture, Yalta, September 19-23, 2006, p. 74-76
- [24] Ovečka M: Mikroskopický pohľad do vnútra rastlinnej bunky [Microscopic insight into the plant cell]. Slovenská botanická spoločnosť, Bratislava, 7.12.2005
- [25] Čiamporová M.: Stress effects on plant cell ultrastructure. Interdisziplinäres Seminar WS 2006/07, Neues aus Licht- und Elektronen-mikroskopie, Universität Wien, 20. 11. 2006

ii. List of employees who served as members of the organising and/or programme committees for international conferences

- [1] 2003 (12): I. Mistrík, M. Čiamporová, M. Luxová, O. Gašparíková, K. Dekánková, S. Budíková, V. Banášová, P. Lizoň, E. Michalková, I. Hodálová, V. Feráková, K. Marhold,
- [2] 2004 (10): I. Mistrík, M. Čiamporová, M. Luxová, O. Gašparíková, K. Marhold, M. Zaliberová, I. Jarolímek, H. Oťaheľová, M. Valachovič, R. Hrivnák
- [3] 2005: (5): F. Hindák, A. Lackovičová, A. Guttová, E. Lisická, P. Lizoň
- [4] 2006 (8): F. Hindák, A. P. Lizoň, S. Adamčík, V. Kučera P. Meredá, V. Banášová, M. Ndubinská, M. Čiamporová

iii. List of employees who served as members of important international scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

- [1] **Algological Studies**, Germany – **F. Hindák**
- [2] **Algologia**, Ukraine – **F. Hindák**
- [3] **Annales de Limnology**, France – **F. Hindák**
- [4] **Biologia Plantarum**, Czech Republic - **O. Gašparíková**
- [5] **Czech Mycology**, Czech Republic - **P. Lizoň**
- [6] **Folia Geobotanica**, Czech Republic - **K. Marhold, J. Lihová**
- [7] **Monographie Botanicae**, Poľsko - **M. Zaliberová**
- [8] **Mycotaxon**, USA - **P. Lizoň**
- [9] **Phytocoenologia**, Germany - **M. Valachovič**
- [10] **Polish Journal of Botany**, Poland - **P. Lizoň, K. Marhold**
- [11] **Plant and Soil**, Holandsko - **F. Baluška**
- [12] **Taxon**, Wien, Rakúsko - **K. Marhold**
- [13] **Ukrainian Phytosociological Collection**, Ukrajina - **I. Jarolímek**
- [14] **Plant Signaling and Behavior**, USA - **F. Baluška**

iv. List of international scientific awards and distinctions

- [1] **Miroslava Luxová**, The JSRR Award from the Japanese Society for Root Research, for excellent achievement in root research (2004)
- [2] **František Hindák**, Honorary membership, The Polish Botanical Society

• National position of the individual researchers

i. List of invited/keynote presentations at national conferences documented by an invitation letter or programme

- [1] Hindák, F., 2003: Prehľad našich červených rias (Rhodophyta). Hydrobiologický kurz, Modra-Harmónia, 26.-30. 5. 2003
- [2] Hindáková, A., 2003: K problematike určovania rozsievok usporiadaných do kolónií. Hydrobiologický kurz, Modra-Harmónia, 26.-30. 5. 2003
- [3] Ořahelová, H., Valachovič, M., Tóthová, L., 2003: Metodika a praktické skúsenosti stanovenia vodných makrofytov v tokoch. Hydrobiologický kurz, Modra-Harmónia, 26.-30. 5. 2003
- [4] Hindák, F., 2003: Fenotypová a ekologická charakteristika potenciálne toxických planktónových siníc na Slovensku. Inauguračná prednáška na Fakulte ekológie a environmetalistiky Zvolenskej university, Banská Štiavnica, 27. 11. 2003.
- [5] Hindák, F., 2004: Planktónové chlorokokálne a ulotrichálne riasy rieky Dunaja a Moravy v Bratislave. Hydrobiologický kurz, Bratislava, 24.-30. 5. 2004.
- [6] Hindáková, A., 2004: Porovnanie fytoplanktónových rozsievok rieky Moravy a Dunaja v Bratislave. Hydrobiologický kurz, Bratislava, 24.-30. 5. 2004.
- [7] Hindák, F., 2005: Zelené kokálne riasy (Chlorococcales, Chlorophyceae). Hydrobiologický kurz, Bratislava, 26.-30. mája 2003. (vyžiadaná prednáška)
- [8] Hindáková A., 2005: K výskytu nárastových rozsievok vo fytoplanktóne. Hydrobiologický kurz, Bratislava, 26.-30. 5. 2003.
- [9] Hindák, F., 2005: Podiel RNDr. Ladislava Hanušku, CSc. na rozvoji slovenskej a európskej algológie a hydrobiológie. Seminár Jesenný algologický seminár 2005, Bratislava, 8. 12. 2005.
- [10] Lackovičová, A. Viazaný a neviazaný život lišajníkov: ekologické nároky. Strom života, odborný seminár „Environmentálna výchova v lese“, Oravská Lesná, 29. 9.- 1. 10. 2006.
- [11] Lackovičová, A. K najnovším lichenoidikačným výskumom na Slovensku. Strom života, odborný seminár „Environmentálna výchova v lese“, Oravská Lesná, 29. 9.- 1. 10. 2006.
- [12] Makovinská, J., Hindák, F., 2006: Zelené bičíkaté riasy (Phytomonadina). Hydrobiologický kurz, Bratislava, 15.-18. 5. 2006

ii. List of employees who served as members of organising and programme committees of national conferences

- [1] P. Lizoň, Biodiverzita húb Slovenska [Biodiversity of the Fungi in Slovakia]. 3, 4, 5, 6. Bratislava 2003 – 2006.
- [2] M. Valachovič, A. Kubinská, F. Hindák, K. Hegedüšová, R. Hrivnák - 8. zjazd Slovenskej botanickej spoločnosti pri SAV, Moravský Svätý Ján, 1.-4. 6.2004
- [3] P. Mered'a – Floristický kurz Pruské a jeho okolie
- [4] K. Marhold, T. Miháliková - Konferencia o službe sprístupňujúcej slovenské biologické zbierky pre Európu (BioCASE Slovak National Meeting)
- [5] F. Hindák - Hydrobiologický kurz 20093, 2004, 2005, 2006
- [6] E. Michalková - Kolokvium o flóre Slovenska
- [7] A. Šrobárová - Projekt SIMOCA, Meetings in each selected case-study area

iii. List of employees serving in important national scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

• editorial boards of scientific journals

- [1] **Acta Facultatis Rerum Naturalium Universitatis Comenianae, Botanica:** V. Feráková – member, 2004
- [2] **Acta fytotechnica et zootechnica** - A. Šrobárová - member
- [3] **Annotationes Zoologicae et Botanicae:** E. Lisická - member
- [4] **Biologia** Bratislava - F. Hindák, Editor in Chief, I. Mistrík - Executive Editor, M. Čiamporová, O. Gašparíková, I. Hodálová, M. Valachovič, P. Mráz, M. Perný – members
- [5] **Biozozológia:** A. Kubinská, I. Jarolímek, – members
- [6] **Bulletin Slovenskej botanickej spoločnosti pri SAV**, Bratislava: F. Hindák (2003-2005), I. Mistrík - Editor in Chief, A. Guttová (2003-2005), L. Franková - Executive Editor, K. Goliašová, I. Jarolímek F. Hindák, A. Guttová – members

iv. List of national awards and distinctions

- [1] F. Hindák – Slovak Academy of Sciences Award for popularisation (2004)
- [2] F. Hindák - Award by Slovak Literature Fund for publication of a book (2004)
- [3] F. Hindák - Honorary membership of the Slovak Limnological Society SAS (2004)
- [4] F. Hindák – Member of the Learnt Society of the Slovak Academy of Sciences (2004)
- [5] I. Jarolímek – Slovak Academy of Sciences Honorary Medal for Activity in Biological Sciences (2004)
- [6] M. Zaliberová, V. Banášová, H. Oľahel'ová – Honorary memberships of the Slovak Botanical Society (2005)
- [7] A. Lackovičová (2005) E. Lisická (2006) - Holuby Memorial Medal of the Slovak Botanical Society
- [8] J. Šibík (PhD student) – Pavol Sillinger Slovak Botanical Society award for young scientists (2005)

Supplementary information and/or comments documenting international and national status of the Organisation

The Institute builds up, maintains, and manages herbarium with the international acronym "SAV", registered in the Index Herbariorum (world index and database of herbarium collections), and collections of microorganisms (cyanobacteria, algae, and microfungi). The herbarium and microorganism collections are of great scientific, cultural-historical, and financial value. They serve to all botanists from both Slovakia and abroad as an evidence of the plant diversity of the country in the past as well as for their comparative taxonomic studies. The herbarium contains also considerable amount of specimens from abroad. The most important of them, is the collection is that of František Nábělek, collected in the Near East in 1909-1910. This herbarium collection is of an outstanding historical and scientific value with numerous type specimens documenting the biodiversity of the area of Turkey, Israel, Iran and Iraq, which has not been sufficiently known until these days. In 2006 the herbarium SAV was enriched with new acquisition of the herbarium specimens originally deposited in the Arboretum Mlyňany (22.500 specimens). This new collection contains mainly herbarium specimens of trees from both natural localities and culture. The Institute builds up, fills up and manages several important databases: Database of chromosome numbers of the ferns and flowering plants of Slovakia (available on-line), Checklist of non-vascular and vascular plants of Slovakia (available on-line, new edition under preparation), the Database of data on the distribution of the ferns and flowering plants of Slovakia, which includes also data on herbarium specimens, and CDF (Central database of phytocoenological relevés in TURBOWIN).

4. Project structure, research grants and other funding resources

- **International projects and funding**

- i. **List of major projects within the European Research Area – 5th and 6th Framework Programme of the EU, European Science Foundation, NATO, COST, INTAS, CERN, etc. (here and in items below please specify: type of project, title, grant number, duration, funding, responsible person in the Organisation and his/her status in the project, e.g. coordinator, principal investigator, investigator)**

[1] **5th Framework Programme of the EU**
European Initiative for the Euro+Med PlantBase
 grant number: **EVR1-CT-2000-40004**
 duration: **09/2000-08/2003**
 funding (Sk): **238 400 (2003)**
 responsible person: **Assoc. Prof.. RNDr. Karol Marhold, CSc.** - principal investigator

[2] **5th Framework Programme of the EU**
BioCASE – A Biodiversity Collection Access Service for Europe
 grant number: **EVR1-CT-2000-40017**
 duration: **11/2001 – 10/2004**
 funding (Sk): **43 900 (2003) 134 000 (2004), 66 239 (2005)**
 responsible person: **assoc. Prof.. RNDr. Karol Marhold, CSc.**, principal investigator

[3] **5th Framework Programme of the EU**

European Network for Biodiversity Information (ENBI)

grant number: EVK2-CT-2002-20020

duration: 01/2003 – 12/2005

funding: mobility (2003, 2004, 2005)

responsible person: Assoc. Prof. RNDr. Karol Marhold, CSc., principal investigator

[4] 6th Framework Programme of the EU**INTRABIODIV – Tracking surrogates for infraspecific biodiversity: towards efficient selection strategies for the conservation of natural genetic resources using comparative mapping and modeling approaches**

grant number: GOCE-CT-2004-505376

duration: 01/2004 – 12/2006

funding (Sk): 886 000 (2004) 429 206 (2005), 340 235 (2006)

responsible person: Assoc. Prof. RNDr. Karol Marhold, CSc., principal investigator

[5] 6th Framework Programme of the EU**European Native Seed Conservation Network (ENSCONET)**

grant number: RICA-CT-2004-506109

duration: 11/2004 – 10/2009

funding (Sk): none (2004), 177 136 (2005), 319 065 (2006)

responsible person: Assoc. Prof. RNDr. Karol Marhold, CSc., principal investigator

[6] 6th Framework Programme of the EU**Towards the European Distributed Institute of Taxonomy (EDIT NoE)**

grant number: GOCE-CT-2006-018340

duration: 03/2006 – 02/2011

funding (Sk): 491 214 (2006)

responsible person: Assoc. Prof. RNDr. Karol Marhold, CSc., principal investigator

[7] 6th Framework Programme of the EU**Bridging genomics and agrosystem management „Resource for adaptation and sustainable production of *Lotus* spp. in environmentally constrained South American soils**

grant number : FP6-517617

duration: 12/2005-11/2008

funding: 23 640 EUR (2006)

responsible person: Assoc. Prof. RNDr. Igor Mistrik, CSc., principal investigator - principal investigator

[8] 6th Framework Programme of the EU**Participation of endomembranes and components of the cell wall in the maintenance of plant cell polarity**

grant number: MERG-CT-2005-031168

duration: 03/2006–02/2007

funding: 40 000 EUR (2006)

responsible person: Mgr. Miroslav Ovečka, PhD. , principal investigator

[9] CASDES INTERREG III B**Production in organic farming** Setting up and implementation of sustainable and multifunctional rural development model based on organic and competitive agriculture

grant number: **2AO18 SIMOCA**
 duration: **01/2003-12/2005**
 funding (Sk): **150 000** (2003), **150 000** (2004), **none** (2005)
 responsible person: **RNDr. Antónia Šrobárová, DrSc.**, principal investigator

[10] COST

Agriculturally important toxigenic fungi

grant number: **COST 835 – 51-98-9710-00 /1997**
 duration: **01/1998-12/2003**
 funding (Sk): **50 000** (2003)
 responsible person: **RNDr. Antónia Šrobárová, DrSc.**, principal investigator

[11] Natura 2000

NATURA 2000 in Slovakia – bridging the implementation process

grant number: **128/037-0022**
 duration: **09/2003-12/2004**
 funding (Sk): **246 000** (2003), **260 000** (2004)
 responsible person: **RNDr. Ivan Jarolímek, CSc.**, principal investigator

[12] National Taxonomic Centre

Principal investigator: Faculty of Sciences, Comenius University, Bratislava

duration: : **09/2006-10/2008**

Responsible investigator in the Institute of Botany: **Assoc. Prof. RNDr. Karol Marhold, CSc.**

ii. List of other international projects incl. funding

[1] Macrophyte Inventory Danube/Corridor and Catchment (MIDCC) (Macrophytes, River Corridor, Land Use, Habitats: A multifunctional study in the Danube catchment based on GIS)

Institute of Ecology and Conservation Biology University of Vienna

grant number: **bm:bwk GZ 45.512/1-VI/B/7a(VIII/B/8a)/2001**

duration: **05/2002–05/2006**

funding: **1000 EUR** (2003), **EUR 501** (2004), **400 EUR** (2005)

responsible person: **RNDr. Helena O'ahel'ová, CSc.**, national coordinator

[2] Project of the European Union

Molecular and cellular mechanisms of tip growth in plant cells

University of Vienna, Cell Imaging and Ultrastructural Research Unit, Division of Cell Physiology and Scientific Film, Vienna, Austria

grant number: **TIPNET HPRN-CT-2002-00265**

duration: **2004 –2005**

funding: **fellowship for 1 postdoc**

responsible person: **Mgr. Miroslav Ovečka, PhD.**

[3] Aktion Österreich-Slowakei

Plants from heavy metal-polluted habitats: specific plant communities and their structural and physiological

University of Vienna, Cell Imaging and Ultrastructural Research Unit, Division of Cell Physiology and Scientific Film, Viena, Austria

grant number: **46s5**

duration: **05/2004-12/2005**
 funding: **2473 EUR (2004), 195 000 (Sk) - mobility (2005)**
 responsible person: **Mgr. Miriam Nadubinská, PhD.**, investigator

[4] Interacademic agreement

Plants of Slovak and Czech Republic

Institute of Botany Academy of Sciences of the Czech Republic

grant number: 141

duration: **2004-2005**

funding (Sk): **29 000 - mobility**

responsible person **RNDr. Kornélia Goliašová, CSc.**, responsible investigator

[5] Interacademic agreement

Vegetation diversity along a continentally gradient in southern Siberia: a key to understanding Early Postglacial history of Central Europe

Masaryk University, Brno, Czech Republic

grant number: –

duration: **2003-2007**

funding: **5000 Czk + mobility**

responsible person **RNDr. Milan Valachovič, CSc.**, investigator

[6] DAAD/SAV agreement

Population differentiation and phylogeographic distribution patterns of two selected polymorphic species groups: *Cardamine flexuosa*/C. *hirsuta* and *Cardaminopsis arenosa* agg. (*Brassicaceae*)

Heidelberg Institute of Plant Science, Heidelberg University, Germany

grant number: –

duration: **01/2004-12/2005**

funding: **mobility**

responsible person **Assoc. Prof. RNDr. Karol Marhold, CSc.**, investigator

[7] Interacademic agreement

Evolutionary phylogenetics and ecological genetics of selected pan-Eurasian *Brassicaceae*, *Arabidopsis* and *Cardamine*

Department of Biology, Faculty of Science, Kobe-University, Japan

grant number: –

duration: **04/2004-03/2006**

funding: **mobility**

responsible person: **Assoc. Prof. RNDr. Karol Marhold, CSc.**, investigator

[8] Interacademic agreement

Diversity of flora of Slovak Republic and Czech Republik II – vascular and non vascular plants

Institute of Botany Academy of Sciences of the Czech Republic

grant number: **SK-CZ-01806**

duration: **01/ 2006 –12/ 2007**

funding (Sk): **35 000 (2006)**

responsible person: **RNDr. Anna Lackovičová, CSc.**, investigator

[9] Interacademic agreement

Euglenophyceae of Slovakia and Poland with special regard to boundary regions

W. Szafer Institute of Botany, Polish Academy of Science, Krakow, Poland

grant number: --

duration: **01/2006 – 12/2008**funding: **mobility**responsible person: **Prof. RNDr. František Hindák, DrSc.**, investigator

[10] Interacademic agreement

Diversity of phytopathogenic fungi and its host plants in the Tatra National Parks

W. Szafer Institute of Botany, Polish Academy of Science, Krakow, Poland

grant number: --

duration: **01/2004-12/2006**funding: **mobility**responsible person: **RNDr. Kamila Bacigálová, CSc.**, investigator

[11] Interacademic agreement

Lichens of the Carpathians: summarizing data on biodiversity

W. Szafer Institute of Botany, Polish Academy of Science, Krakow, Poland

grant number: --

duration: **01/2004-12/2006**funding: **mobility**responsible person: **RNDr. Anna Lackovičová, CSc.** investigator

[12] Interacademic agreement

Effects of heavy metal stress on cell architecture of tip-growing plant cells: Intracellular localization of metal ions

Consejo Superior de Investigaciones Científicas, Centro de Investigaciones Biológicas, Laboratory of Plant Development and Nuclear Organization, Madrid, Spain

grant number: --

duration: **01/2006-12/2007**funding: **mobility**responsible person: **RNDr. Milada Čiamporová, CSc.** investigator

[13] Interacademic agreement

Phytoplankton of the Morava River

Institute of Botany, Třeboň, Academy of Sciences of the Czech Republic

grant number: --2

duration: **01/2006-12/2008**funding: **mobility**responsible person: **RNDr. Alica Hindáková, PhD.**, investigator**iii. List of other important projects and collaborations without direct funding****[1] Toxigenic fungi and their biocontrol**

Istituto Tossine e Micotossine da parassiti Vegetali CNR, BARI, Italy

grant number: **7/06/ Bt /00**duration: **1/2001- 12/2003**responsible person: **RNDr. Antónia Šrobárová, DrSc.****[2] Taxonomic study on the taxa of *Russula* sect. *Xerampelinae* from Siberia and Greenland**

(Transnational access to collections and other resources at Copenhagen Biosystematics Centre)

grant number: HPRI-CT-2001-00129
 duration: 1/2003 – 2/2004
 responsible person: **Mgr. Slavomír Adamčík, PhD**

[3] Vegetation variability on landscape and geographical scale: gradient analysis, classification, interpretations

Masaryk University of Brno (Department of Botany, BioGIS Laboratory), Institute of Ecology and Botany, Vácrátót, Hungary
 Federal Office and Research Centre for Forests, Vienna, Austria
 grant number: **B601630504**
 duration: **2005-2007**
 responsible person: **Mgr. Jana Sadloňová**

[4] Contribution to the life strategy of species *Colchicum autumnale L.*

Eötvös Lorand University, Faculty of Natural Sciences Budapest, Hungary
 Federal Office and Research Centre for Forests, Vienna, Austria
 grant number: --
 duration: **2005-2006**
 responsible person: **RNDr. Otília Gašparíková, CSc.**

[5] Plant communities of Korean Peninsula: first vegetation synthesis of poorly known territory

Institute of Botany, Průhonice, Academy of Sciences of the Czech Republic
 grant number: **206/05/0119**
 duration: **2005-2007**
 responsible person: **RNDr. Ivan Jarolímek, CSc.**

- **National projects and funding**

- i. **List of projects supported by the Agency for the Promotion of Research and Development (APVV/APVT), National Research Programmes, and their funding**

[1] Biodiversity of the phytoplankton of the Danube river and its main tributaries in Slovakia

grant number: **APVT-51-009102**
 duration: **09/2002-08/2005**
 funding (Sk): **212 000 (2003), 234 000 (2004), 163 000 (2005)**
 responsible person: **Prof. RNDr. František Hindák, DrSc.**

[2] Biosystematics of fungi described from Slovakia

grant number: **APVT- 51-023902**
 duration: **08/2002-12/2004**
 funding (Sk) : **141 000 (2003), 235 000 (2004)**
 responsible person: **RNDr. Pavel Lizoň, CSc.**

[3] Change dynamics in lichen diversity of Slovakia

grant number: **APVT-51-005102**
 duration: : **09/2002-08/2005**
 funding (Sk) : **360 000 (2003), 499 000 (2004), 334 000 (2005)**
 responsible person: **RNDr. Anna Lackovičová, CSc.**

- [4] Diversity of the flora of Slovakia with special attention to the trees**
grant number: APVT-51-00702
duration: : : 9/2002-8/2005
funding (Sk) : 315 000 (2003), 135 000 (prevod z r. 2004) + 486 000 (2004), 363 000 (2005)
responsible person: RNDr. Kornélia Goliašová, CSc.
- [5] Ferns and flowering plants described from the territory of Slovakia**
grant number: APVT-51-09202
duration: : : 9/2002-8/2005
funding (Sk): 142 000 (2003), 60 000 (prevod do r. 2004) + 217 000 (2004), 103 000 (2005)
responsible person: RNDr. Helena Šípošová, CSc.
- [6] Chromosome numbers survey of the ferns and flowering plants of**
grant number: APVT-51-006002
duration: 9/2002-8/2005
funding (Sk): 216 000 (2003), 100 000 (prevod z r. 2003) + 370 000 (2004), 424 000 (2005)
responsible person: Assoc. Prof. RNDr. Karol Marhold, CSc.
- [7] Time course and localisation of stress proteins induced by abiotic stresses in plants**
grant number: APVT-51-001002
duration: : 8/2002-8/2005
funding (Sk): 330 000 (2003), 350 000 (2004), 230 000 (2005)
responsible person: Assoc. Prof. RNDr. Igor Mistrik, CSc.
- [8] Identification key of ferns and flowering plants of Slovakia and solving the problems of critical species groups in a Central European area**
grant number: APVT-51-026404
duration: 01/2005-12/2007
funding (Sk): 2 296 000 (2005), 2 012 000 (2006)
responsible person: Assoc. Prof. RNDr. Karol Marhold, CSc.
- [9] Formalized classification system for identification of grassland vegetation**
grant number: 51-015804
duration: 01/2005-12/2007
funding (Sk): 607 000 (2005), 518 000 (2006)
responsible person: Mgr. Monika Janišová, PhD.
- [10] Impact of changes in air quality of urban agglomeration Bratislava on lichens**
grant number: APVT-51-040805
duration: 01/2005-12/2007
funding (Sk) : 1 107 000 (2006)
responsible person: RNDr. Anna Lackovičová, CSc.
- [11] Phylogenetic relationships of the *Alyssum montanum* – *A. repens* complex (Brassicaceae)**
grant number: LPP-0085-06
duration: 11/2006-11/2010
funding (Sk): 103 000 (2006)
responsible person: Assoc. Prof. RNDr. Karol Marhold, CSc.

ii. **Number of projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding**

VEGA	2003	2004	2005	2006
number	16	17	22	19
funding (millions of SKK)	1,453	1,566	1,816	1,988

• **Summary of funding from external resources**

External resources	2003	2004	2005	2006	total	average
external resources (millions of SKK)	4,833	6,220	7,681	14,357	33,091	8,273
external resources transferred to cooperating research organisations (millions of SKK)	0,050	0,060	0,370	0,262	0,742	0,186
ratio between external resources and total salary budget	0,306	0,384	0,457	0,810	1,956	0,489
overall expenditures from external as well as institutional resources (millions of SKK)	31,617	33,937	38,279	42,867	146,700	36,675

Supplementary information and/or comments on research projects and funding resources

Financial resources for the frontier research in all branches of the research on biodiversity have permanently been too poor since long time. Our knowledge of life variability and heterogeneity, fundamental processes in organisms and ecosystems, processes of biodiversity decline at both global and national level is underestimated. Numerous memoranda, declarations, conventions and also agreements remain on a sheath of paper only. There are no (or minimum) special funds for their realisation at Slovak national level: Grant agencies VEGA, APVV or Ministry of Environment SR have had no public calls for solution of biodiversity tasks.

A slightly better situation exists at European level. However, successful researchers, who obtain a grant from the EU have to cope with discrepancy between the Slovak and European financial rules. Many months shift and delay of money delivery from the EU force the researchers (and their state institutions especially) to balance on the edge of the laws of the Slovak Republic.

5. Organisation of PhD studies, other pedagogical activities

- i. List of accredited programmes of doctoral studies (as stipulated in the previously effective legislation as well as in the recently amended Act on the Universities)

15-07-9 botanika [botany]

15-05-9 fyziológia rastlín [plant physiology]

15-13-9 mykológia [mycology]

- ii. Summary table on doctoral studies (number of internal/external PhD students; number of students who completed their study by a successful thesis defence; number of PhD students who quitted the programme)

PhD study	31.12.2003			31.12.2004			31.12.2005			31.12.2006		
number of potential PhD supervisors	27 supervisors			27 supervisors			28supervisors			29 supervisors		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
internal	11	3	0	13	2	0	10	4	5	10	0	2
external	10	2	1	11	1	0	11	0	1	9	0	1
supervised at external institution by the research employees of the assessed organisation	8	2	1	6	1	0	4	0	0	5	0	0

- iii. Postdoctoral positions supported by

a) external funding (specify the source)

RNDr. Judita Lihová, PhD. – Alexander von Humboldt Fellowship (2004-2005)

Mgr. Miroslav Ovečka, PhD. – postdoc 2004-2005

b) internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

RNDr. Judita Lihová, PhD.

RNDr. Marta Ollé-Šimonovičová, PhD.

iv. Summary table on pedagogical activities in undergraduate programmes for each year

Teaching	2003	2004	2005	2006
lectures (hours/year)	245	249	242	256
practicum courses (hours/year)	182	124	184	118
supervised diploma works (in total)	24	16	17	14
members in PhD committees (in total)	13	13	12	12
members in DrSc. committees (in total)	2	2	1	1
members in university/faculty councils (in total)	1	2	2	1
members in habilitation/inauguration committees (in total)	2	2	3	2

v. List of published university textbooks

- [1] GÁPER, J., **PIŠŮT, I.**: Mykológia. Systém, vývoj a ekológia húb. [Mycology. System, development, and ecology of fungi] Banská Bystrica: Univerzita Mateja Bela, 2003, 212 s. ISBN 80-8055-863-9

vi. Number of published academic course books

none

vii. List of joint research laboratories/facilities with the universities

- [1] Departments of Plant Physiology in both Institute of Botany, and Faculty of Natural Sciences, Comenius University Bratislava
- [2] National Taxonomy Facility (NaTaF) - research taxonomy facility supporting research and education in taxonomy and systematics of living organisms, joining departments of zoology, botany of the Faculty of Sciences, Comenius University Bratislava, Departments of non-vascular and vascular plants of the Institute of Botany SAS, Department of entomology of the Institute of Zoology SAS, Departments of zoology and botany of the Slovak National Museum, and Institute of Biological and Ecological Sciences, Faculty of Sciences, P.J.Šafárik University Košice.

viii. Supplementary information and/or comments on doctoral studies and pedagogical activities

1. The actual status of the process of PhD dissertation defence can be considered as a step back. In contrast to the previous rules, every faculty has the right to create its own commission

and, consequently the criteria and the standard of the defending process may vary substantially and thus it may be incomparable.

2. The Institute of Botany organizes 1-day-seminar of PhD students of the Institute regularly, every year. It is a duty for each student, both internal and external to present his/her results obtained during the passed year. An internal committee evaluates their presentations and three best of them are awarded a special price.

6. Direct output to the society

(applications of results, popularisation and outreach activities)

i. List of the most important results of applied research projects

[1] Application of the research results in actualizing the Decree of the Ministry of the Environment of the Slovak Republic (2006)

Commissioned by the Ministry of the Environment of the Slovak Republic

Critical revision of the selection of lichens (20 taxa), fungi (70 taxa), bryophytes (14 taxa) and vascular plants (51 taxa) listed in the decree No. 24/2003 Z.z., for executing the law No. 543/2002 Z.z on the nature and landscape protection, exerted by the decree No. 492/2006 Z.z.

The social value of the protected plants, animals, biotopes of European as well as national importance is expressed by the means of their biological, ecological, and cultural value. In each taxon, several criteria were taken into account: number of localities in which a particular taxon occurs, number and stability of these localities, reasons of threat of a taxon, importance of a taxon from scientific point of view, compactness of the area, vitality of the taxon populations, ability of its propagation, endurance (persistence) and habitus of a taxon, utilization of a taxon (or its organs) by man, relationship to criminal-law responsibility, etc.

[2] Evaluation of environmental quality of selected areas

The results of investigations on diversity and distribution of non-vascular plants were used in an assessment of the environmental conditions of several areas such as nature reserves, non-forest ecosystems, and rivers in Slovakia.

The study of cyanophytes and algae in Danube River showed a generally good, mesotrophic water quality within the German-Austrian-Slovak parts of the river, whereas the Hungarian part is eutrophic. The investigations of the Morava River since the late 1950s show that water quality has been improved, nevertheless the river has still an eutrophic status. Mycological research of non-forest habitats in Slovakia allowed to select the indicator species of the natural value of grasslands. Based on occurrence of the fungi the first evaluations of some biotopes were prepared.

The results of our study of model taxa of lichens (the families *Collema* spp., *Gyalecta* spp. and *Umbilicaria* spp.) contributed to clarification of the process of changing the lichen diversity in Slovakia. To evaluate current environmental conditions of several areas an Index of Ecological Continuity (IEC) was calculated based on the occurrence of the species of the reference list of indicatory species. High environmental quality (IEC > 25) was confirmed in Tatry National Park, NP Poloniny and in the Biosphere Reserve Poľana.

The changes signaling initial regeneration of biotopes on permanent plots in the vicinity of smelters in Krompachy were identified as a result of the decrease of immission burden in this area. The signals are represented by primary occurrence of terrestrial lichens (*Cladonia rei*, *Diploschistes muscorum*) and the moss (*Ceratodon purpureus*) on the plots. On spoil heaps near Smolník (Slovenské Rudohorie Mts.) the lichen species such as *Cladonia carneola*, *Lecanora*

handellii, *L. subaurea*, *Stereocaulon nanodes*, capable to tolerate long-term increased amounts of metals (mostly Cu, As, Fe) in substrate were recorded.

Our results of the research on diversity of cryptogams in the protected areas in Slovakia were forwarded to the State Nature Conservancy bodies and relevant Administrations of protected areas as the grounds for extending the knowledge on total biodiversity and for following up the future potential changes (e.g. after the calamity in Tatry Mts. in December 2004). Scientific information on the occurrence of lichens and bryophytes were applied to select Important Plant Areas in Slovakia in 2004 under the PlantLife project (total area of the IPAs comprises 13% of the area of the country, ca 6449 km²).

ii. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign organisations

Commissioned by the Government

1. Expertise for the plenipotentiary of the Slovak Republic for construction and operation of the Gabčíkovo - Nagymaros Hydropower Scheme: In: Lisický M.J., Mucha I. (eds.): Optimization of water regime of the branch system in the Danube river part Dobrohošť – Sap from the environmental aspect. H. Ořaheřová
2. Accreditation Committee – Research in Life Sciences – O. Gašparíková – member

The Ministry of the Environment

✓ Membership in committees and advisory groups:

1. Coordinator Group on invasion species – H. Šípořová, M. Zaliberová – members
2. Coordinator Group on research and protection of bryophytes and lichens by the State Nature Protection of the SR, Banská Bystrica - A. Guttová, A. Lackovičová, E. Lisická, A. Kubinská - members
3. Advisory committee of the Minister of the Environment – M. Valachovič, H. Ořaheřová – members
4. Slovak Committee of the Ramsar Convention on Wetlands, the advisory committee of the Minister of the Environment – H. Ořaheřová – member
5. Consulting committee of the State Nature Protection of the SR – V. Feráková – member
6. Small projects competition committee – P. Meredřa - member
7. Biodiversity protection Committee – K. Marhold – member

✓ Reports and expertises commissioned by the State Nature Protection (řtátna ochrana přírody SR):

1. Actual State of the research, working and exploiting the collections of particularly protected as well as non-protected vascular plants, K. Goliařová
2. Protected Landscape Region Pořana – inventory research on lichens and bryophytes in the National Natural Reserve Dobroč primary forest (Volovské vrchy Mts.): Species occurrence, proposal of preservation measures, evaluation of the region from the point of view of its preservation level and threat due to negative factors, for the management purposes, A. Lackovičová, A. Kubinská

3. Preliminary list of invasion non-vascular plants, listing the invasively spreading alochtonous and autochtonous species of cyanobacteria, algae, micro- , and macro-scopic, and lichenized fungi in the territory of Slovakia, F. Hindák, A. Hindáková, K. Bacigálová, P. Lizoň, A. Lackovičová.
4. The Protected Landscape Region Strážovské vrchy Mts: inventory research on lichens and bryophyta of the National Nature Reserve Podskalský Roháč and the proposed reserve Podhradská lesostep, A. Guttová, K. Kresáňová
5. Management of the National Nature Reserve Vihorlat – mycofloristic research resulted in identification of 445 taxa of the fungi Ascomycetes and Basidiomycetes, S. Adamčík, V. Kučera
6. Expertise on the water vegetation of the Klátovské rameno branch and Listové jazero lake for the Nature Protection Region Dunajské luhy, H. O'ahel'ová, R. Hrivnák, M. Valachovič
7. Expertise on vegetation of water reservoirs, for the National Park Slovenský raj. H. O'ahel'ová, R. Hrivnák, M. Valachovič
8. Review on the proposal for extending the National Reserve primary forest Kyjovský prales in the Vihorlat Mts., for the Protected Landscape Region Východné Karpaty (East Carpathians). A. Lackovičová
9. Inventory research of lichens and bryophytes in Záhorie lowland, the selected areas of European interest – for the Protected Landscape Region Záhorie. A. Guttová, A. Kubinská
10. Inventory research of lichens and bryophytes in the Natural Reserves Rokoš and adjacent regions of the southern part of the Strážovské vrchy Mts – for the Protected Landscape Region Ponitrie. A. Guttová, A. Kubinská, A. Lackovičová
11. For the Nature Landscape Region Záhorie: Expertise review on the locality Devínske jazero lake and Stupavský potok stream – phytocoenological evaluation and importance of the localities with respect to Natura 2000, K. Hegedúšová
12. Continuous services in determination of plant material provided to the institutions of the State Nature Protection

Other institutions, NGOs

1. National Bank of Slovakia Committee for selection of subjects for the Slovak notes, coins, and co-memorable coins – I. Jarolímek, member
2. Participation in revitalisation, and a sustained monitoring of the cyanobacteria, algae, and macrophytes in the Štrkovecké jazero lake in the district of the City of Bratislava, Commissioned by the Municipal Department , F. Hindák, A. Hindáková, H. O'ahel'ová
3. Expertise on the water vegetation of a gravel lake in Adamov, commissioned by Municipal Department in the city of Gbely, H. O'ahel'ová
4. Expert service providing cultures of cyanobacteria and algae for biological tests in SR, F. Hindák.

International institutions

- ✓ Participation in the project „Important Botanical Territories“ within the Program Planta Europa, organised by the British organisation PlantLife International: protected and endemic taxa of lichens (29), bryophytes (34) and vascular plants (23) were selected. Data on their recent occurrence were elaborated as a contribution to distinguishing and characterisation of a network of 157 most valuable areas of Slovakia with respect to plant occurrence, representing 13% of the total territory of Slovakia i.e. 6 449 km². **I. Hodálová, V. Feráková, A. Guttová, A. Lackovičová, A. Kubinská**

iii. List of the most important popularisation activities

[1] Number of articles popularising research activities and results of the Institute:

- Other popularising articles:
 - LISICKÁ, E., LACKOVIČOVÁ, A.:** Kalamita v Tatrách verzus lišajníky. Správy SAV 2005, 10: 12.
 - LIHOVÁ J.** Aj rastliny majú svoje príbehy. In Quark 2006, Roč. 12 (1), s. 18-19.
 - FERÁKOVÁ V.** Príroda Devína. Už znova rozkvitol klinček...Devínčan 4/6, (2006), s. 5
 - FERÁKOVÁ V.** Invázne rastliny. Aktuálny problém aj v Devíne. Devínčan 4/8, (2006), s. 5
 - ŠKODOVÁ I.** 2006: Prechádzka po Stupavskom parku. "Stupava - história, pamiatky, osobnosti, príroda", ročník II., číslo 2: 42 – 47.
- Advices for gardeners and farmers on breeding and protection of crop plants: 2003 - **138**, 2004 - **190**, 2005 - **106**, 2006 - **156**

[2] Contributions published by broadcast and TV

2003 - **2**, 2004 - **8**, 2005 - **3**, 2006 - **1**

[3] Popularising lectures

2004 - **2**, 2005 - **2**, 2006 - **6**

[4] Within the European Week of Science:

2004 - Open-door Day with lectures and botanical guiding in the garden area of the Institute

2005 and 2006 - lectures for the students of the Gymnasium Pankuchova Bratislava on botanical research and impact of the results on the environment (three lectures each year)

iv. List of patents issued abroad, incl. revenues

none

v. List of the patents issued in Slovakia, incl. revenues

none

vi. List of licences sold abroad, incl. revenues

none

vii. List of licences sold in Slovakia, incl. revenues

none

viii. List of contracts with industrial partners, incl. revenues

none

ix. List of research projects with industrial partners, incl. revenues

none

x. Summary of outreach activities

Outreach activities	2003	2004	2005	2006	total
studies for the decision sphere, government and NGOs, international and foreign organisations	5	10	6	7	28
articles in press media/internet popularising results of science, in particular those achieved by the Organization	138	190	107	162	597
appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	2	8	3	2	15
public popularisation lectures	10	5	5	6	26

xi. Supplementary information and/or comments on applications and popularisation activities

none

7. Background and management. Staffing policy and implementation of findings from previous assessments

i. Summary table of personnel

Personnel	2003	2004	2005	2006
all personel	83	99	98	90
research employees from Tab. Research staff	48	54	53	59
FTE from Tab. Research staff	45	48	47,25	51,1
averaged age of research employees with university degree	43	42	41	42

ii. Professional qualification structure

Number of	2003	2004	2005	2006
DrSc.	2	2	3	3
PhD / CSc.	37	37	43	46
Prof.	0	1	1	1
Doc./Assoc. Prof.	4	3	3	3

iii. Status and development of research infrastructure incl. experimental, computing and technical base (description of the present infrastructure, premises, and material and technical resources. Infrastructure, instrumentation and major technical equipment necessary for the achievement of the objectives specified in the research Concept)

The Department of Plant Physiology is grouped of experts in plant physiology, molecular biology, biochemistry, and microscopy. All of them have a long-term experience in the studies of stress physiology and morphogenesis of root cells. This experience in the field of stress physiology and functional anatomy along with good and modern technical equipments make possible to realize the ongoing research at high professional level. The laboratory of stress physiology is equipped with modern instruments for separation and analysis of proteins (Beckman U-8 ultracentrifuge, FPLC, gel slab electrophoresis, UV-VIS spectrometer, fluorescence reader, etc.) and nucleic acids analysis (PCR). The laboratory of functional anatomy is equipped with various types of microscopes (light, fluorescence, electron, confocal, image analysers). An integrated approach in this field is based on application of modern methods of confocal microscopy, videomicroscopy, evanescent wave microscopy and immunofluorescence and immuno-electron localization techniques. Great experience and modern technical equipments are the main reason that both groups are leading teams in this field in Slovakia and collaborate with many institutions in Europe (Vienna, Bonn, Darmstadt, Madrid, Sevilla, and Bristol).

The laboratory of molecular systematics at the Institute of Botany was established in 2005, and officially launched in December 2005.

The laboratory equipped facilitates running standard molecular systematic techniques, including plant DNA extraction, PCR, PCR-RFLP, post-PCR purification, and AFLP analyses. DNA

sequencing and fragment analyses are performed with DNA sequencers of the BITCET consortium, located in the Department of Molecular Biology, Comenius University, Bratislava. Research activities in the laboratory are focused on taxonomic, evolutionary and phylogeographic questions, and are connected to the current projects in the Institute. The laboratory is located in the Institute of Geology SAS, Valašská ulica street, Bratislava.

iv. Status and development of bibliographic resources, activities of the Organisation's library and/or information centre

The library of the Institute of Botany possesses 24 198 units. It represents a basic information centre providing services for scientists and students such as journal- and book-loan, foreign language terminology, inter-librarian and international loans, copies of the literature not available in the institute or in Slovakia. The library ensures international exchange of journal or book issues (with more than 50 partners), building database of the publications published by the researchers of the Institute in the system Advanced Rapid Library (2 840 notes), database of the books and periodicals in the system ISIS, elaboration of citation indices from the databases WOS and SCOPUS as well as from monographs and other sources.

v. Describe how the results and suggestions of the previous assessment were taken into account

The process of the previous accreditation of the Institute of Botany in 2003 has not resulted in any critical comments, or recommendations for the future period.

vi. Supplementary information and/or comments on management, research infrastructure, and trends in personnel development

none

Other information relevant to the assessment

none