

# Questionnaire

## Summary of the main activities of a research institute of the Slovak Academy of Sciences

Period: January 1, 2012 - December 31, 2015

### 1. Basic information on the institute:

#### 1.1. Legal name and address

Institute of Plant Genetics and Biotechnology of the Slovak Academy of Sciences  
Akademická 2, P.O.BOX 39A, 950 07 Nitra

#### 1.2. URL of the institute web site

<http://pribina.savba.sk/ugbr>

#### 1.3. Executive body of the institute and its composition

Directoriat	Name	Age	Years in the position
Director	assoc. prof. RNDr. Ján Salaj, DrSc.	64	7
Deputy director	RNDr. Alena Gajdošová, CSc. (for science) and Ing. Henrieta Kvapilová (for economy)	58 and 41	6 and 7
Scientific secretary	Ing. Andrea Hricová, PhD.	44	6

#### 1.4. Head of the Scientific Board

RNDr. Radoslava Matúšová, PhD.

#### 1.5. Basic information on the research personnel

1.5.1. Number of employees with university degrees (PhD students included) engaged in research projects, their full time equivalent work capacity (FTE) in 2012, 2013, 2014, 2015, and average number of employees in the assessment period

	2012		2013		2014		2015		total		
	number	FTE	number	FTE	number	FTE	number	FTE	number	averaged number per year	averaged FTE
Number of employees with university degrees	23,0	19,510	21,0	19,780	20,0	15,850	19,0	14,770	83,0	20,8	17,478
Number of PhD students	12,0	10,050	13,0	10,580	10,0	7,990	10,0	6,720	45,0	11,3	8,835
Total number	35,0	29,560	34,0	30,360	30,0	23,840	29,0	21,490	128,0	32,0	26,313

### 1.5.2. Institute units/departments and their FTE employees with university degrees engaged in research and development

Research staff	2012		2013		2014		2015		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
Institute in whole	23,0	19,510	21,0	19,780	20,0	15,850	19,0	14,770	20,8	17,478
Dept. of Molecular Biology and Biotechnology	8,0	6,350	7,0	7,000	6,0	6,080	6,0	5,900	6,8	6,333
Dept. of Population Genetics and Breeding	7,0	5,810	9,0	7,320	8,0	6,400	8,0	5,440	8,0	6,243
Dept. of Reproduction and Developmental Biology	5,0	4,100	5,0	4,470	6,0	3,370	5,0	3,430	5,3	3,843
Dept. of Cell Biology	3,0	3,250	0,0	0,990	0,0	0,000	0,0	0,000	2,3	3,200

### 1.6. Basic information on the funding of the institute

#### Institutional salary budget and others salary budget

Salary budget	2012	2013	2014	2015	average
<b>Institutional Salary budget</b> [thousands of EUR]	30,656	30,781	30,041	31,165	<b>30,660</b>
<b>Other Salary budget</b> [thousands of EUR]	32,956	19,081	19,323	17,666	<b>22,257</b>

### 1.7. Mission Statement of the Institute as presented in the Foundation Charter

The purpose and main subject of the Institute's research activities, as shown by Foundation Charter, is the scientific research focused on plant genetics and plant biotechnology.

In the field of population genetics, the Institute deals with the study of hybridological relationships, genetic polymorphism and biodiversity of selected forest tree species. The populations are characterized at the biochemical and molecular levels using isozymes and DNA markers.

The genetic research includes also orientation to plant embryogenesis (both zygotic and somatic), studying of its cytological, morphological, biochemical and molecular aspects. The regulation and *in vitro* regeneration and micropropagation of plants are studied in forest and fruit trees as well as in selected agricultural crops, aiming in elaboration the effective systems for mass-production of high quality (even genetically modified) plant material.

In the field of genetic engineering, the possibilities of plant genome modifications by introduction of foreign genes into the genome of economically important plant species are studied with the aim to improve their quality and/or resistance against environmental stresses. Studies on expression of transgenes and factors influencing the gene expression as well as bio-safe plants are in focus of research interests.

Recently, the orientation of research activities have been devoted to the studies of plant proteomics during plant embryogenesis and development under normal and polluted environment, especially in radioactively contaminated areas.

Reproduction of valuable genetic resources obtained through hybridological experiments and *in vitro* approaches and their conservation using cryopreservation are conducted, as well.

The release of results by publishing in scientific journals and organizing the conferences/workshops for professional community and dissemination of these results to the public is also stated by Foundation Charter.

Moreover, the IPGB SAS is an external education organization providing doctoral study in three PhD programmes and maintains a close collaboration with universities at the level of graduating and post-graduating students supervising bachelor, diploma and PhD thesis.

The IPGB offers some consultation and expert services in the fields of its mission.

#### **1.8. Summary of R&D activity pursued by the institute during the assessment period in both national and international contexts, (recommended 5 pages, max. 10 pages)**

Among the research institutes of the Slovak Academy of Sciences (SAS), belonging to the Section II – „Life, Chemical, Medical and Environmental Sciences“, the **Institute of Plant Genetics and Biotechnology (IPGB SAS)** belongs to the smaller ones. Nevertheless, it plays an important role in the structure of this Section because it is the only institute with orientation to the study of genetic patterns of plant growth and development, as well as plant biotechnology. Even if the main focus is on theoretical aspects of genetic and molecular mechanisms of plant development, the attention has been given to the negative impacts of environmental factors on plant production, adaptation to changing environmental conditions and nature protection. For these purposes a broad scale of approaches, involving molecular biology, genetic engineering, *in vitro* techniques and different –omics technologies, have been used.

##### **Department of Population Genetics and Breeding**

The IPGB SAS has a long tradition of research on **population genetics and breeding** of forest trees, particularly conifers. In the field of population genetics, the attention has been given to clarification of the genetic status and fertility of the hybrid swarm populations of Scots pine (*Pinus sylvestris* L.) and Mountain dwarf pine (*P. mugo* Turra) in northern Slovakia (Kormutak et al., 2013, 2014, Manka et al., 2015). The research was aimed at the description of the hybrid swarm populations in molecular and fertility terms as unique endemic species in our territory.

Due to the steady decline of firs (*Abies alba*) population in the Slovak forests the breeding effort at the IPGB on halting this decline is still ongoing. New hybrid combinations have been tried based on controlled pollination of *Abies alba* with *Abies* species of Asian (*A. holophylla*), North American (*A. procera*) and/or Mediterranean (e.g., *A. nordmanniana* and *A. pinsapo*) origin (Galgoci et al., 2013, Kormutak et al. 2012, 2013, 2015). In the international context, the dynamics of antioxidant enzymes (GPX, CAT, APX, SOD) in the needles of interspecific hybrids of *Abies cephalonica* x *A. numidica*, *A. cephalonica* x *A. alba*, *A. cephalonica* x *A. nordmanniana* have been studied in the frame of COST Action FP 1106 “Studying tree responses to extreme events”. The growth parameters of interspecific hybrids of *Abies alba* x *A. numidica*, *A. alba* x *A. pinsapo*, *A. nordmanniana* x *A. numidica* and *A. pinsapo* x *A. numidica* in the age of 4 years were studied in the frame of COST Action FP1403 “Non-native tree species for European forests – experiences, risks and opportunities”.

Recent *in vitro* research, in addition to the study of fundamental aspects of induction (Fraterova et al. 2013, Salaj T. et al. 2014, 2015), maturation, embryonic regeneration and conservation of obtained *in vitro* material, builds also on above genetic research. Valuable and for further research and practice promising hybrids have been used as a starting material for their propagation via somatic embryogenesis approach (Nedela et al. 2012, Vookova, Kormutak 2014).

The experiments focused on cryo-conservation of valuable embryogenic tissues are integral part of *in vitro* approach. These experiments are based on long-term cooperation with Catholic University in Leuven, Belgium (Salaj T. et al. 2012, 2015).

The importance of this research has been confirmed by the COST Action FP 0701 “Micropropagation of conifer trees – an alternative method of plant production” in which researchers from IPGB took part, too.

Genetic transformation of embryogenic tissues of conifers, in particular *Pinus* species and *Abies* hybrids, has been studied in the context of COST Action FP 0905 “Biosafety of forest

transgenic trees: improving the scientific basis for safe tree development and implementation of EU police directives”.

*In vitro* approach has also been used for micropropagation of selected less known small fruit species. This area of research is focused on practical use, partly based on cooperation with the Fruit Research Institute Čačak, Serbia. For these purposes, the efficient protocols for micropropagation of selected cultivars of blueberries (*Vaccinium corymbosum*, *V. vitis-idaea*), raspberries and blackberries (*Rubus idaeus*, *Rubus fruticosus*), serviceberry (*Amelanchier alnifolia*) and plums (*Prunus* spp.) were elaborated (Ružič et al. 2012; Libiakova et al. 2013, 2015; Gajdosova et al. 2015) aiming at potential commercial cooperation with private companies.

The research on small fruit species has also been oriented towards genetic transformation of selected small fruit species by *Agrobacterium tumefaciens* (Gajdosova et al. 2015, Sukenikova et al. 2015).

Real practical output was achieved by the research focused on mutation breeding of amaranth (*Amaranthus* spp.) – a 21<sup>st</sup> century crop. The mutant lines of *Amaranthus cruentus*, previously obtained from mutual irradiation experiments at the IAEA in Vienna, were long-term and extensively studied and subsequently tested in field conditions for their production and nutrition properties. The breeding effort resulted in the registration of a new variety “Pribina” - first Slovak amaranth variety (with co-author from the Prešov University in Prešov, SK) and was granted of Breeder's Certificate. In addition, the Minister of Agriculture awarded the Institute a “Golden sickle” on the occasion of the International Exhibition “Agrokomples 2015”.

### **Department of Molecular Biology and Biotechnology**

At the time of dramatically changing climatic conditions a great emphasis is placed on research dealing with the effects of environmental stresses on plant production. At the IPGB, many advanced approaches of -omics technologies were successfully used in the study of plant **stress response** during the assessment period. The plant defense mechanisms of various types of biotic and abiotic stress have been studied at both national and international level. Particular attention was given to the study of plant defense responses to heavy metals such as cadmium (Konotop et al. 2012; Dobrovicka et al. 2013; Galusova et al. 2015; Socha et al. 2015) or arsenic (Dobrovicka et al. 2013; Meszaros et al. 2013, 2014), mostly in collaboration with Constantine the Philosopher University in Nitra. In these experiments also the Research Institute of Plant Production (Piešťany, SK), as a partner involved in breeding of crops, took part. At the national level this topic has been studied in the project granted by Slovak Grant Agency VEGA, No. 2/0062/11 “Study of the defense responses of soybean (*Glycine max* L.) against ions of selected heavy metals”. The final goal of these studies is to identify the genes that are involved in plant defense against drought or heavy metal stress and reflect the obtained knowledge into agricultural practice (e.g. Marker Assisted Selection).

The mutual project of the Research Institute of Plant Production (Piešťany, SK) and the IPGB under the title “Biological diversity of wheat, improvement for adaptability under global change and the use of organic agriculture” has been granted by the Slovak Research and Development Agency under the contract No. APVV-0197-10.

The projects focused on such environmental factors as a drought or wind have been studied in cooperation with Austrian partner, AIT Tulln (Spiess et al. 2012; Kopecky et al. 2013, Gregorova et al. 2015). The problem of winter wheat pathogen damage (*Microdochium nivale*) was studied in cooperation with Institute of Plant Physiology PAN, Krakow (Zur et al. 2013). The research focused on pathogen attacks has been carried out also in the frame of COST Action FA 1208 “Pathogen-informed strategies for sustainable broad-spectrum crop resistance”.

A special group of phytopathogens are parasitic plants belonging to Orobanchaceae family, which are considered as dangerous pests causing substantial losses of crop production in many countries of the world. The IPGB joined this promising and from the production point of view very important topic through cooperation with the laboratory of Prof. H. Bouwmeester (Wageningen UR). At the IPGB, the research has been focused on germination and cultivation of genera *Phelipanche* by the project VEGA 2/0139/11 “Development of efficient

transformation and regeneration protocol of *Phelipanche ramosa* (L.) Pomel". As a result, *in vitro* culture system and regeneration protocol for selected species was established (Kulacova and Matusova 2015). It has been found (Koltai et al. 2012) that parasitic plants germinate after exposition to chemical signals exuded from the roots of the host plants. The most studied germination stimulants belong to strigolactones (SLs), the newly discovered plant hormones, which are stimulating hyphal branching of arbuscular mycorrhizal fungi and are involved in the regulation of shoot and root architecture of plants (Ruyter-Spira et al. 2013). Identification and isolation of natural strigolactones is very difficult due to very low level in plants and rhizosphere. Therefore, synthetic strigolactone analog GR24 has been used (cooperation with Slovak University of Agriculture, Nitra) in prevalent studies dealing with dormancy and germination of weedy parasitic plants belonging to *Orobancha*, *Phelipanche* and *Striga* spp. (Matusova et al. 2014). Recently, the IPGB is a member of COST Action FA 1206 "Strigolactones: biological roles and applications" (2013-2017).

**Genetic engineering** has become a powerful tool in plant biology research aimed to improve agronomic and industrial traits of crops and woody plant species even at IPGB. Because the testing and validating *in planta* performance in a promoter–reporter context prior to attempting any general biotechnology application has been shown to be a sensible strategy, one part of transgenesis research at IPGB is focused towards to „promotor’s study“. This area of research activities has been studied in the frame of domestic project VEGA, No. 2/0090/14 „Testing of genes for specific hydrolytic enzymes in plant transgenesis in order to use them to strengthen defense against pathogens“. To ensure a tissue-specific transgene expression in GM plants a tissue-specific promoters have been studied (Jopcik et al. 2013, 2015; Boszoradova et al. 2014). For that reason the influence of the distance of the *CaMV35S* promoter/enhancer on expression profiles of four *Arabidopsis thaliana* pollen- and/or embryo-specific promoters, *APRS*, *ESL*, *MXL*, and *DLL*, was tested in transgenic tobacco plants (Jopcik et al. 2014a, b). It appears that the *CaMV35S* promoter, which is in most cases used to drive expression of the selectable marker gene in transgenic plants, is able to change the tissue-specific profile of many promoters to constitutive when they are closely located.

The promoter *DLL*, that had been shown to be immune to the *CaMV35S* promoter influence, was used for control of the specific splicing of the selectable marker gene (encoding resistance to the antibiotics) in the pollen and the embryo, when the transgenic plants from the non-transgenic had been successfully selected. Progeny of such plants contain only the target gene. A key element in terms of efficiency excision event appears to be the promoter that triggers *cre* recombinase expression that represents the molecular scissors for splicing of the *loxP* cassette (Poloniova et al. 2015)

In the frame of the bilateral project with Ukraine partners entitled "The influence of the overexpression of cinnamyl alcohol dehydrogenase gene in transgenic poplar on the process of lignifications" international cooperation was performed. Within this project our experience with plant transformation techniques to our partner's workplace was transferred.

Besides the issue of transgenic plants the attention has been paid also on carnivorous plants which are considered to be an abundant source of compounds with antimicrobial/antifungal activity. Among them, a sundew (*Drosera rotundifolia*) has long been a "favorite" plant in the lab. Previously we have isolated two sundew genes encoding for chitinase and glucanase, which are members of the pathogenesis-related proteins of plants and play a role in several vital plant processes. They are expected to support defense machinery against pathogens following their introduction into the target organism. In addition to their antifungal properties and carnivory digestion (Michalko et al. 2013), they were found to be involved in the process of somatic embryogenesis (Fraterova et al. 2014). In addition, we have identified chitinase isoforms as stable components of the general plant defense mechanism against heavy metal stress, while some of the isoforms were shown to be metal specific (Meszaros et al. 2014).

The experiments focused on sundew transformation (Blehova et al. 2015) have been performed in cooperation with the Faculty of Science (Comenius University, Bratislava).

Due to the high antifungal potential of carnivorous plants, even at present, the research focused on the isolation and characterization of new genes coding for hydrolytic enzymes is still in progress.

### **Department of Reproduction and Developmental Biology**

The research group at this department is oriented to the study of environmental stress, mostly based on international cooperation with partners from both Europe and overseas. The research has been focused on the environmental problems caused by human activities such as soil and air pollution - namely to the radio-contaminated environment around the atomic power station in the Chernobyl region. In the frame of bilateral and multilateral projects there is a long-term cooperation with Institute of Cell Biology and Genetic Engineering of National Academy of Sciences of Ukraine in Kiev. Research activities are focused on the study of adaptation mechanisms of crop plants as soybean, flax, wheat, maize, etc. on an increased level of radiation caused by the Chernobyl disaster, growing in contaminated and control experimental fields in the Chernobyl region (Klubicova et al. 2012, Rasydov and Hajduch 2015). The above mentioned research activities were supported by national and international grant agencies, e.g., by VEGA (project No. 2/0126/11 "The elucidation of plant adaptation in contaminated Chernobyl area") and APVV (bilateral project No. SK-PT-0016-10 with Portugal partner "Phosphoproteomic analysis of mature seeds harvested from soybean grown in radioactive and control fields in Chernobyl area" and project No. APVV-0740-11 "Understanding of plant adaptation in the radioactive Chernobyl area").

The project MIRG-CT-2007-200165 granted by FP7 "The quantitative proteomics analysis of developing embryo, endosperm and seed coat in controlled and Chernobyl-grown plants" has finished in 2012.

In 2014 started a new multinational project granted by FP7 (under the scheme of MC IRSES proj. No. 612587) focused on "Plant adaptation to heavy metal and radioactive pollution". The role of this project is the exchange of staff, in particular young scientists. Thanks to this project many students and young scientists from abroad have spent some period working at IPGB in Nitra.

However, using an advanced research infrastructure available at the IPGB and partner's laboratories at the Institute of Virology SAS and Slovak University of Agriculture, also the proteomic analyses in developing zygotic and somatic embryos or in plants exposed to heavy metal stress have been performed, too.

With regard to other important activity analyses of allergens in wheat grains (Uvackova et al. 2012) were granted by Syngenta Biotechnology, USA in 2012. This research followed a grant from VEGA, No. 2/0016/14 "Proteomics mapping of clinically relevant proteins in wheat grains".

The cooperation with partners in Tsukuba (Japan) has been focused on proteomic analysis of flooded soybean seedlings (Nanjo et al. 2012). In the frame of Slovak-Taiwan bilateral project "Investigate the mechanism of male sterility regulated by *DEFECTIVE IN ANTHWER DEHISCENCE1 (DAD1)* – Activating Factor (DAF), a Ring-finger E3 ligase gene and its agricultural application" the attention has been paid do developmental processes during plant embryogenesis.

It is worth to mention that during the assessment period the IPGB took part in 4 EU SF projects. Two of them "**Utilization of innovative scientific approaches for increasing of efficiency in forest management**"(No. TT 01359) and "**Biotechnologies as a tool of advanced agriculture for overcoming of anticipated climatic changes (drought, increasing temperature)**" (TT 01326) were intended to promote the education of public on topics the Institute is dealing with.

In two other projects the Institute participated with the Research Institute of Plant Production in Piešťany (**ITMS 26220220097: Implementation of the research of plant genetic resources and its maintaining in the sustainable management of Slovak Republic**) and with two universities in Nitra (**ITMS 26220220180: Creation of Research Centre "AgroBioTech"**) Both projects have contributed significantly to improving research infrastructure at the Institute.

## **2. Partial indicators of main activities:**

### **2.1. Research output**

#### **2.1.1. Principal types of research output of the institute: basic research/applied research, international/regional (ratios in percentage)**

basic research/applied research: 75/25%

international/regional: 60/40%

#### **2.1.2 List of selected publications documenting the most important results of basic research. The total number of publications listed for the assessment period should not exceed the average number of employees with university degrees engaged in research projects. The principal research outputs (max. 5, including Digital Object Identifier - DOI) should be underlined**

- [1] BAUER, Miroslav - LIBANTOVÁ, Jana - MORAVČÍKOVÁ, Jana - PIRŠELOVÁ, Beáta. Glukanázy a chitinázy v rastlinných biotechnológiách. Nitra, Fakulta prírodných vied UKF, 2012. 146 s. ISBN 978-80-558-0199-5.
- [2] KOLTAI, Hinanit - MATUŠOVÁ, Radoslava - KAPULNIK, Yoram. Strigolactones in root exudates as a signal in symbiotic and parasitic interactions. In Secretions and Exudates in Biological Systems. Berlín, Springer Berlin Heidelberg, 2012, p.49-73. ISBN 978-3-642-23047-9.
- [3] NANJO, Yohei - ŠKULTÉTY, Ľudovít - UVÁČKOVÁ, Ľubica - KLUBICOVÁ, Katarína - HAJDUCH, Martin - KOMATSU, Setsuko. Mass spectrometry-based analysis of proteomic changes in the root tips of flooded soybean seedlings. In Journal of Proteome Research, 2012, vol. 11, no.1, p. 372-385. (5.113 - IF2011). (2012 - Current Contents). ISSN 1535-3893.
- [4] SALAJ, Terézia - MATUŠÍKOVÁ, Ildikó - SWENNEN, Rony - PANIS, Bart - SALAJ, Ján. Long-term maintenance of *Pinus nigra* embryogenic cultures through cryopreservation. In Acta Physiologiae Plantarum, 2012, vol. 34, no. 1, p.227-233. (1.639 - IF2011). (2012 - Current Contents). ISSN 0137-5881. DOI:10.1007/s11738-011-0821-x.
- [5] JOPČÍK, Martin - BAUER, Miroslav - MORAVČÍKOVÁ, Jana - BOSZORÁDOVÁ, Eva - MATUŠÍKOVÁ, Ildikó - LIBANTOVÁ, Jana. Plant tissue-specific promoters can drive gene expression in *Escherichia coli*. In Plant Cell, Tissue and Organ Culture, 2013, vol.113, no.3, p. 387-396. (3.633 - IF2012). (2013 - Current Contents). ISSN 0167-6857.
- [6] KLUBICOVÁ, Katarína - DANCHENKO, Maksym - ŠKULTÉTY, Ľudovít - BEREZHNA, Valentyna V. - RASHYDOV, Namik - HAJDUCH, Martin. Radioactive Chernobyl environment has produced high-oil flax seeds that show proteome alterations related to carbon metabolism during seed development. In Journal of Proteome Research, 2013, vol. 12, no. 11, p. 4799-4806. (5.056 - IF2012). (2013 - Current Contents). ISSN 1535-3893. DOI: 10.1021/pr400528m.
- [7] KORMUŤÁK, Andrej - VOOKOVÁ, Božena - ČAMEK, Vladimír - SALAJ, Terézia - GALGÓCI, Martin - MAŇKA, Peter - BOLEČEK, P. - KUNA, Roman - KOBLIHA, Jaroslav - LUKÁČIK, Ivan - GÖMÖRY, Dušan. Artificial hybridization of some *Abies* species. In Plant Systematics and Evolution, 2013, vol. 299, no. 6, p. 1175-1184. (1.312 - IF2012). (2013 - Current Contents). ISSN 0378-2697. DOI:10.1007/s00606-013-0787-9.
- [8] MÉSZÁROS, Patrik - RYBANSKÝ, Ľubomír. - HAUPTVOGEL, Pavel - KUNA, Roman - LIBANTOVÁ, Jana - MORAVČÍKOVÁ, Jana - PIRŠELOVÁ, Beáta - TIRPÁKOVÁ, Anna - MATUŠÍKOVÁ, Ildikó. Cultivar-specific kinetics of chitinase induction in soybean roots during exposure to arsenic. In Molecular Biology Reports, 2013, vol. 40, no. 3, p. 2127-2138. (2.506 - IF2012). (2013 - Current Contents). ISSN 0301-4851.
- [9] MICHALKO, Jaroslav - SOCHA, Peter - BLEHOVÁ, Alžbeta - LIBANTOVÁ, Jana - MORAVČÍKOVÁ, Jana - MATUŠÍKOVÁ, Ildikó. Glucan-rich diet is digested and taken

up by the carnivorous sundew (*Drosera rotundifolia* L.): implication for a novel role of plant  $\beta$ -1,3-glucanases. In *Planta*, 2013, vol. 238, no. 4, p. 715-725. (3.347 - IF2012). (2013 - Current Contents). ISSN 0032-0935. DOI:10.1007/s00425-013-1925-x.

- [10] PIRŠELOVÁ, Beáta - MATUŠÍKOVÁ, Ildikó. Callose: The plant cell wall polysaccharide with multiple biological functions. In *Acta Physiologiae Plantarum*, 2013, vol. 35, no. 3, p. 635-644. (1.305 - IF2012). (2013 - Current Contents). ISSN 0137-5881.
- [11] QUESADA, Víctor - SARMIENTO-MAÑÚS, Raguél - GONZÁLEZ-BAYÓN, Rebeca - HRICOVÁ, Andrea - ROSA PONCE, María - LUIS MICOL, José. Porphobilinogen deaminase deficiency alters vegetative and reproductive development and causes lesions in *Arabidopsis*. In *PLoS ONE*, 2013, vol. 8, no. 1, e53378. (3.730 - IF2012). (2013 - MEDLINE). ISSN 1932-6203.
- [12] RUYTER-SPIRA, Carolien - LÓPEZ-RÁEZ, Juan Antonio - CARDOSO, Catarina - CHARNIKHOVA, Tatsiana - MATUŠOVÁ, Radoslava - KOHLEN, Wouter - JAMIL, Muhammad - BOUTS, Ralph - VERSTAPPEN, Francel - BOUWMEESTER, Harro. Strigolactones: a cry for help results in fatal attraction. Is escape possible? In *Isoprenoid Synthesis in Plants and Microorganisms: New Concepts and Experimental Approaches*. New York, Springer Science+Business Media, 2013, p.199-211. ISBN 978-1-4614-4063-5.
- [13] UVÁČKOVÁ, Ľubica - ŠKULTÉTY, Ľudovít - BEKEŠOVÁ, Slávka - McCLAIN, S. - HAJDUCH, Martin. MS<sup>(E)</sup> based multiplex protein analysis quantified important allergenic proteins and detected relevant peptides carrying known epitopes in wheat grain extracts. In *Journal of Proteome Research*, 2013, vol. 12, no. 11, p. 4862-4869. (5.056 - IF2012). (2013 - Current Contents). ISSN 1535-3893. DOI:10.1021/pr400336f.
- [14] UVÁČKOVÁ, Ľubica - ŠKULTÉTY, Ľudovít - BEKEŠOVÁ, Slávka - McCLAIN, Scott - HAJDUCH, Martin. The MS<sup>(E)</sup> - proteomic analysis of gliadins and glutenins in wheat grain identifies and quantifies proteins associated with celiac disease and baker's asthma. In *Journal of Proteomics*, 2013, vol. 93, p. 65-73. (4.088 - IF2012). (2013 - Current Contents). ISSN 1874-3919.
- [15] DUBAS, Ewa - MORAVČÍKOVÁ, Jana - LIBANTOVÁ, Jana - MATUŠÍKOVÁ, Ildikó - BENKOVÁ, Eva - ZUR, Ivona - KRZEWSKA, Monika. The influence of heat stress on auxin distribution in transgenic *B.napus* microspores and microspore-derived embryos. In *Protoplasma*, 2014, vol. 251, no. 5, p.1077-1087. (3.171 - IF2013). (2014 - Current Contents). ISSN 0033-183X.
- [16] LIU, Qing - ZHANG, Yanxia - MATUŠOVÁ, Radoslava - CHARNIKHOVA, Tatsiana - AMINI, Maryam - JAMIL, Muhammad - FERNANDEZ-APARICIO, Monica - HUANG, Kan - TIMKO, Michael P. - WESTWOOD, James H. - RUYTER-SPIRA, Carolien - van der KROL, Sander - BOUWMEESTER, Harro J. *Striga hermonthica* MAX2 restores branching but not the very low fluence response in the *Arabidopsis thaliana* max2 mutant. In *New Phytologist*, 2014, vol. 202, no. 2, p. 531-541. (6.373 - IF2013). (2014 - Current Contents). ISSN 0028-646X.
- [17] VARHANÍKOVÁ, Miroslava - UVÁČKOVÁ, Ľubica - ŠKULTÉTY, Ľudovít - PREŤOVÁ, Anna - OBERT, Bohuš - HAJDUCH, Martin. Comparative quantitative proteomic analysis of embryogenic and non-embryogenic calli in maize suggests the role of oxylipins in plant totipotency. In *Journal of Proteomics*, 2014, vol. 104, p. 57-65. (3.929 - IF2013). (2014 - Current Contents). ISSN 1874-3919.
- [18] POLÓNIOVÁ, Zuzana - JOPČÍK, Martin - MATUŠÍKOVÁ, Ildikó - LIBANTOVÁ, Jana - MORAVČÍKOVÁ, Jana. The pollen- and embryo-specific *Arabidopsis* DLL promoter bears good potential for application in marker-free *Cre/loxP* self-excision strategy. In *Plant Cell Reports*, 2015, vol. 34, no. 3, p. 469-481. (3.071 - IF2014). (2015 - Current Contents). ISSN 0721-7714. DOI:10.1007/s00299-014-1726-0.
- [19] MATEO-BONMATI, Eduardo - CASANOVA-SAEZ, Ruben - QUESADA, Viktor - HRICOVÁ, Andrea - CANDELA, Héctor - MICOL, Jose Luis. Plastid control of abaxial-adaxial patterning. In *Scientific Reports*, 2015, vol. 5, article Number: 15975. (5.578 - IF2014). (2015 - Current Contents, Scopus, WOS). ISSN 2045-2322.

- [20] SÚKENÍKOVÁ, Miroslava - LIBIAKOVÁ, Gabriela - MORAVČÍKOVÁ, Jana - HRICOVÁ, Andrea - GAJDOŠOVÁ, Alena. *Agrobacterium tumefaciens*-mediated transformation of blackberry (*Rubus fruticosus* L.). In Plant Cell, Tissue and Organ Culture, 2015, vol.120, no.1, p.351-354. (2.125 - IF2014). (2015 - Current Contents). ISSN 0167-6857. DOI:10.1007/s11240-014-0569-2.

### 2.1.3 List of monographs/books published abroad

none

### 2.1.4. List of monographs/books published in Slovakia

- [1] BAUER, Miroslav - LIBANTOVÁ, Jana - MORAVČÍKOVÁ, Jana - PIRŠELOVÁ, Beáta. Glukanázy a chitinázy v rastlinných biotechnológiách. [Glucanases and chitinases in plant biotechnologies, In Slovak].Nitra: Fakulta prírodných vied UKF, 2012. 146 s. ISBN 978-80-558-0199-5.

### 2.1.5. List of other scientific outputs specifically important for the institute, max. 10 items

- [1] KONOTOP, Yevheniia - MÉSZÁROS, Patrik - SPIEß, Nadine - MISTRÍKOVÁ, Veronika - PIRŠELOVÁ, Beáta - LIBANTOVÁ, Jana - MORAVČÍKOVÁ, Jana - TARAN, Natalia - HAUPTVOGEL, Pavel - MATUŠÍKOVÁ, Ildikó. Defense responses of soybean roots during exposure to cadmium, excess of nitrogen supply and combinations of these stressors. In Molecular Biology Reports, 2012, vol. 39, no. 12, p. 10077-10087. (2.929 - IF2011). (2012 - Current Contents). ISSN 0301-4851.
- [2] FEKEC SOVÁ, Soňa - DANCHENKO, Maksym - UVÁČKOVÁ, Ľubica - ŠKULTÉTY, Ľudovít - HAJDUCH, Martin. Using 7 cm immobilized pH gradient strips to determine levels of clinically relevant proteins in wheat grain extracts. In Frontiers in Plant Science, 2015, vol. 6, article 433, eCollection. (3.948 - IF2014). (2015 - Current Contents). ISSN 1664-462X.
- [3] NEDĚLA, V. - HŘIB, J. - VOOKOVÁ, Božena. Imaging of early conifer embryogenic tissues with the environmental scanning electron microscope. In Biologia Plantarum, 2012, vol.56, no.3, p. 595-598. (1.974 - IF2011). (2012 - Current Contents). ISSN 0006-3134.
- [4] BOSZORÁDOVÁ, Eva - LIBANTOVÁ, Jana - MATUŠÍKOVÁ, Ildikó - MORAVČÍKOVÁ, Jana. Application of *Arabidopsis* tissue-specific CRUC promoter in the *Cre/loxP* self-excision strategy for generation of marker-free oilseed rape: potential advantages and drawbacks. In Acta Physiologiae Plantarum, 2014, vol. 36, no. 6, p.1399-1409. (1.524 - IF2013). (2014 - Current Contents). ISSN 0137-5881.
- [5] JOPČÍK, Martin - MATUŠÍKOVÁ, Ildikó - MORAVČÍKOVÁ, Jana - LIBANTOVÁ, Jana. Expression pattern of *Arabidopsis thaliana* pollen- and embryo-specific promoter in transgenic tobacco plants. In Acta Biologica Cracoviensia, series Botanica, 2014, vol. 56, no.1, p. 73-79. (0.662 - IF2013). (2014 - Current Contents). ISSN 0001-5296.
- [6] MÉSZÁROS, Patrik - RYBANSKÝ, Ľubomír - SPIEß, N. - SOCHA, Peter - KUNA, Roman - LIBANTOVÁ, Jana - MORAVČÍKOVÁ, Jana - PIRŠELOVÁ, Beáta - HAUPTVOGEL, Pavel - MATUŠÍKOVÁ, Ildikó. Plant chitinase responses to different metal-type stresses reveal specificity. In Plant Cell Reports, 2014, vol. 33, no.11, p. 1789-1799. (2.936 - IF2013). (2014 - Current Contents). ISSN 0721-7714.
- [7] JOPČÍK, Martin - MATUŠÍKOVÁ, Ildikó - MORAVČÍKOVÁ, Jana - ĎURECHOVÁ, Dominika - LIBANTOVÁ, Jana. The expression profile of *Arabidopsis thaliana* beta-1,3-glucanase promoter in tobacco. In Molecular Biology, 2015, vol. 49, no.4, p. 543-549. (0.718 - IF2014). ISSN 0026-8933.
- [8] BLEHOVÁ, Alžbeta - ŠVUBOVÁ, Renáta - LUKÁČOVÁ, Z. - MORAVČÍKOVÁ, Jana - MATUŠÍKOVÁ, Ildikó. Transformation of sundew: pitfalls and promises. In Plant Cell,

Tissue and Organ Culture, 2015, vol. 120, no. 2, p. 681-687. (2.125 - IF2014). (2015 - Current Contents). ISSN 0167-6857

[9] GREGOROVÁ, Zuzana - KOVÁČIK, J. - KLEDUS, B. - MAGLOVSKI, Marína - KUNA, Roman - HAUPTVOGEL, Pavel - MATUŠÍKOVÁ, Ildikó. Drought-induced responses of physiology, metabolites, and PR proteins in *Triticum aestivum*. In Journal of Agricultural and Food Chemistry, 2015, vol.63, no.37, p.8125-8133. (2.912 - IF2014). (2015 - Current Contents). ISSN 0021-8561.

[10] RASHYDOV, Namik M. - HAJDUCH, Martin. Chernobyl seed project. Advances in the identification of differentially abundant proteins in a radio-contaminated environment. In Frontiers in Plant Science, 2015, vol. 6, article 493. (3.948 - IF2014). (2015 - Current Contents). ISSN 1664-462X.

**2.1.6. List of patents, patent applications, and other intellectual property rights registered abroad, incl. revenues**

none

**2.1.7. List of patents, patent applications, and other intellectual property rights registered in Slovakia, incl. revenues**

[1] **Application for plant variety protection certificate**

New grain amaranth (*Amaranthus cruentus* L.) variety „Pribina“

(Ministry of Agriculture and Rural Development of the Slovak Republic)

[2] **Application for registration of new variety**

Interspecific hybrid *Amaranthus hypochondriacus* x *Amaranthus hybridus* L.,

Application No. 214R453

(Office for Variety Registration, The Central Controlling and Testing Institute in Agriculture, Bratislava, Slovak Republic)

### 2.1.8. Table of research outputs (as in annual reports).

Papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.

Scientific publications	2012			2013			2014			2015			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
Scientific monographs and monographic studies in journals and proceedings published abroad (AAA, ABA)	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,0	0,000	0,000
Scientific monographs and monographic studies in journals and proceedings published in Slovakia (AAB, ABB)	1,0	0,034	0,033	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	1,0	0,3	0,010	0,008
Chapters in scientific monographs published abroad (ABC)	1,0	0,034	0,033	1,0	0,033	0,032	0,0	0,000	0,000	0,0	0,000	0,000	2,0	0,5	0,019	0,016
Chapters in scientific monographs published in Slovakia (ABD)	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,0	0,000	0,000
Scientific papers published in journals registered in Current Contents Connect (ADCA, ADCB, ADDA, ADEB)	13,0	0,440	0,424	18,0	0,593	0,585	10,0	0,419	0,333	15,0	0,698	0,481	56,0	14,0	0,532	0,457
Scientific papers published in journals registered in Web of Science Core Collection and SCOPUS (ADMA, ADMB, ADNA, ADNB)	2,0	0,068	0,065	6,0	0,198	0,195	3,0	0,126	0,100	2,0	0,093	0,064	13,0	3,3	0,124	0,106
Scientific papers published in other foreign journals (not listed above) (ADEA, ADEB)	3,0	0,101	0,098	1,0	0,033	0,032	0,0	0,000	0,000	1,0	0,047	0,032	5,0	1,3	0,048	0,041
Scientific papers published in other domestic journals (not listed above) (ADFA, ADFB)	4,0	0,135	0,130	5,0	0,165	0,162	4,0	0,168	0,133	6,0	0,279	0,193	19,0	4,8	0,181	0,155
Scientific papers published in foreign peer-reviewed proceedings (AEC, AECA)	4,0	0,135	0,130	2,0	0,066	0,065	1,0	0,042	0,033	7,0	0,326	0,225	14,0	3,5	0,133	0,114
Scientific papers published in domestic peer-reviewed proceedings (AED, AEDA)	0,0	0,000	0,000	5,0	0,165	0,162	6,0	0,252	0,200	5,0	0,233	0,160	16,0	4,0	0,152	0,130
Published papers (full text) from foreign and international scientific conferences (AFA, AFC, AFBA, AFDA)	1,0	0,034	0,033	0,0	0,000	0,000	4,0	0,168	0,133	0,0	0,000	0,000	5,0	1,3	0,048	0,041
Published papers (full text) from domestic scientific conferences (AFB, AFD, AFBB, AFDB)	5,0	0,169	0,163	0,0	0,000	0,000	0,0	0,000	0,000	0,0	0,000	0,000	5,0	1,3	0,048	0,041

- **Supplementary information and/or comments on the scientific outputs of the institute.**

## 2.2. Responses to the research outputs (citations, etc.)

### 2.2.1. Table with citations per annum.

*Citations of papers from international collaborations in large-scale scientific projects (Dwarf team, ALICE Collaboration, ATLAS collaboration, CD Collaboration, H1 Collaboration, HADES Collaboration, and STAR Collaboration) have to be listed separately.*

Citations, reviews	2011		2012		2013		2014		total		
	number	No. / FTE	number	averaged number per year	av. No. / FTE						
Citations in Web of Science Core Collection (1.1, 2.1)	418,0	14,141	422,0	13,900	439,0	18,414	444,0	20,661	1723,0	430,8	16,371
Citations in SCOPUS (1.2, 2.2) if not listed above	19,0	0,643	22,0	0,725	19,0	0,797	35,0	1,629	95,0	23,8	0,903
Citations in other citation indexes and databases (not listed above) (3.2,4.2,9,10)	5,0	0,169	0,0	0,000	0,0	0,000	0,0	0,000	5,0	1,3	0,048
Other citations (not listed above) (3, 4, 3.1, 4.1)	20,0	0,677	33,0	1,087	29,0	1,216	27,0	1,256	109,0	27,3	1,036
Reviews (5,6)	0,0	0,000	0,0	0,000	0,0	0,000	0,0	0,000	0,0	0,0	0,000

## 2.2.2. List of 10 most-cited publications, with number of citations, in the assessment period (2011 – 2014).

- [1] RUYTER-SPIRA, Carolien - KOHLEN, Wouter - CHARNIKHOVA, Tatsiana – van ZEIJL, Arjan - van BEZOUWEN, Laura - de RUIJTER, Norbert - CARDOSO, Catarina - LOPEZ-RAEZ, Juan Antonio - MATÚŠOVÁ, Radoslava - BOURS, Ralph - VERSTAPPEN, Francel - BOUWMEESTER, Harro. Physiological effects of the synthetic strigolactone analog GR24 on root system architecture in *Arabidopsis*: another below ground role for strigolactones? In *Plant Physiology*, 2011, vol. 155, no. 2, p. 721-734. (6.451 - IF2010). (2011 - Current Contents). ISSN 0032-0889. Cited **103x**
- [2] MATÚŠOVÁ, Radoslava - RANI, Kumkum - VERSTAPPEN, Francel W.A. - FRANSSSEN, Maurice C.R. - BEALE, Michael H. - BOUWMEESTER, Harro J. The strigolactone germination stimulants of the plant-parasitic *Striga* and *Orobanch*e spp. are derived from the carotenoid pathway. In *Plant Physiology*, 2005, vol. 139, no. 2, p. 920-934. (5.881 - IF2004). (2005 - Current Contents). ISSN 0032-0889. Cited **97x**
- [3] BOUWMEESTER, Harro J. - MATÚŠOVÁ, Radoslava - SUN, Zhongkui - BEALE, Michael H. Secondary metabolite signalling in host-parasitic plant interactions. In *Current Opinion in Plant Biology*, 2003, vol. 6, no. 4, p. 358-364. (9.504 - IF2002). ISSN 1369-5266. Cited **55x**
- [4] HAJDUCH, Martin - RAKWAL, Randeep - AGRAWAL, Ganesh K. - YONEKURA, Masami. - PREŤOVÁ, Anna. High-resolution two-dimensional electrophoresis separation of proteins from metal-stressed rice (*Oryza sativa* L.) leaves: Drastic reductions/fragmentation of ribulose-1,5-bisphosphate carboxylase/oxygenase and induction of stress-related proteins. In *Electrophoresis*, 2001, vol. 22, no. 13, p. 2824-2831. (3.385 - IF2000). (2001 - Current Contents). ISSN 0173-0835. Cited **40x**
- [5] BEKESIOVÁ, Ildikó - NAP, Jan P. - MLYNÁROVÁ, Ludmila. Isolation of high quality DNA and RNA from leaves of the carnivorous plant *Drosera rotundifolia*. In *Plant Mol Biol Rep.* vol. 17, no. 3 (1999), p. 269-277. ISSN 0735-9640. Cited **33x**
- [6] HAJDUCH, Martin - CASTEEL, Jill E. - HURRELMMEYER, Katherine E. - SONG, Zhao - AGRAWAL, Ganesh K. - THELEN, Jay J. Proteomic analysis of seed filling in *Brassica napus*. Developmental characterization of metallic isozymes using high-resolution two-dimensional gel electrophoresis. In *Plant Physiology*, 2006, vol. 141, no. 1, p. 32-46. (6.114 - IF2005). (2006 - Current Contents). Cited **32x**
- [7] KATAVIC, Vesna - AGRAWAL, Ganesh K. - HAJDUCH, Martin - HARRIS, Stefan L. - THELEN, Jay J. Protein and lipid composition analysis of oil bodies from two *Brassica napus* cultivars. In *Proteomics*, 2006, vol.6, no. 16, p.4586-4598. ISSN 1615-9853. Cited **31x**
- [8] BALUŠKA, František - SALAJ, Ján - MATHUR, Jaideep - BRAUN, Markus - JASPER, Fred - ŠAMAJ, Jozef - CHUA, Nam-Hai - BARLOW, Peter W. - VOLKMANN, Dieter. 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*, 2000, vol. 227, no. 2, p. 618-632. (2000 - Current Contents). ISSN 0012-1606. Cited **29x**
- [9] BALUŠKA, František - JÁSIK, Ján - EDELMANN, Hans G. - SALAJ, Terézia - VOLKMANN, Dieter. Latrunculin B-induced plant dwarfism: plant cell elongation is F-actin-dependent. In *Developmental Biology*, 2001, vol. 231, no. 1, p. 113-124. (5.540 - IF2000). ISSN 0012-1606. Cited **27x**
- [10] AGRAWAL, Ganesh K.r - HAJDUCH, Martin - GRAHAM, Katherine - THELEN, Jay J. In-depth investigation of the soybean seed - filling proteome and comparison with a parallel study of rapeseed. In *Plant Physiology*, 2008, vol. 148, no.1, p. 504-518. ISSN 0032-0889. Cited **24x**

**2.2.3. List of most-cited authors from the Institute (at most 10 % of the research employees with university degree engaged in research projects) and their number of citations in the assessment period (2011– 2014).**

[1] Radoslava Matúšová (2011/56, 2012/66, 2013/88, 2014/90) = 300

[2] Martin Hajduch (2011/68, 2012/71, 2013/81, 2014/69) = 289

- **Supplementary information and/or comments on responses to the scientific output of the institute.**

**2.3. Research status of the institute in international and national contexts**

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

**2.3.1. List of the most important research activities demonstrating the international relevance of the research performed by the institute, incl. major projects (details of projects should be supplied under Indicator 2.4). Max. 10 items.**

During assessed period the Institute continued an extensive international collaboration with many European research institutes and institutes outside of Europe. We present the most important collaborations and research activities:

**[1] 7th Framework program of the European Union**

Plant adaptation to heavy metal and radioactive pollution

Project duration: 01/2014 – 10/2017

Principal investigator: Martin Hajduch

**[2] Collaboration with Syngenta Biotechnology (USA)**

Project title: Systematic MS<sup>E</sup>-based quantification of allergenic and celiac disease proteins in wheat grain

Project duration: 12/2010 – 12/2012

Principal investigator: Martin Hajduch

**European Cooperation in Science and Technology – COST Actions**

In framework of EU COST programme we cooperated and coordinated the research activities with European research institutes and institutes from COST International Partner Countries:

**[3] COST FP0905**

Biosafety of forest transgenic trees: improving the scientific basis for safe tree development and implementation of EU policy directives

Project duration: 04/2010 – 04/2014

Principal investigator at IPGB SAS: Terézia Salaj

**[4] COST FP1106**

Studying tree responses to extreme events: a synthesis

Project duration: 02/2012 – 04/2016

Principal investigator at IPGB SAS: Andrej Kormuťák

**[5] COST FA1206**

Strigolactones: biological roles and applications

Project duration: 04/2013 – 04/2017

Principal investigator at IPGB SAS: Radoslava Matúšová

[6] **COST FA1208**

Pathogen-informed strategies for sustainable broad-spectrum crop resistance

Project duration: 04/2013 – 04/2017

Principal investigator at IPGB SAS: Jana Libantová

**Bilateral projects**

Objectives of bilateral projects are often focused on the establishment of new or intensifying already existing international scientific collaboration. Their financial support is limited to mobility, with special support for young scientists.

[7] **Project title: Molecular markers in the analysis of auxin distribution in oilseed androgenic embryos**

The Slovak Academy of Sciences – The Polish Academy of Sciences project

Collaborating institute: The Franciszek Górski Institute of Plant Physiology, Polish Academy of Sciences, Krakow, Poland

Project duration: 01/2010 – 12/2012

Principal investigator: Jana Moravčíková

[8] **Project title: The influence of the overexpression of cinnamyl alcohol dehydrogenase gene in transgenic poplar on the process of lignification**

Collaborating institute: Institute of Cell Biology and Genetic Engineering, The National Academy of Sciences of Ukraine, Kyiv, Ukraine

Project duration: 01/2011 – 12/2013

Principal investigator: Jana Libantová

[9] **Project title: Assessment of genetic fidelity of *in vitro* propagated small fruits (*Rubus* and *Vaccinium* spp.)**

Slovak Research Development Agency project

Collaborating institute: Fruit and Grape Research Centre, Čačak, Serbia

Project duration: 01/2012 – 12/2013

Principal investigator: Alena Gajdošová

[10] **The membership and position of scientists in international committees**

(e.g., Anna Preťová – COST programme, Domain Committee Member for domain "Food and Agriculture" and national delegate of EPSO; Alena Gajdošová – president of the European Amaranth Association; Andrej Kormuťák – member of Committee of Gregor Mendel Genetic Society; etc.), membership in editorial boards of international journals is also of importance. IPGB SAS is the collective member of the international research organisation EPSO (European Plant Science Organisation).

**2.3.2. List of international conferences (co)organised by the institute.**

[1] **41<sup>st</sup> Annual Meeting of ESNA „Advances in Agrobiological Research and their Benefits to the Future" and international workshop „Recent Advances in Plant Biotechnology"**

September 24 - 28, 2012

Stará Lesná, Slovakia

IPGB SAS organizer of the international workshop „Recent Advances in Plant Biotechnology" and co-organizer of 41<sup>st</sup> Annual Meeting of ESNA

[2] **Neglected and Under-utilized Species Research in 21<sup>st</sup> Century: 6<sup>th</sup> International Conference of the European Amaranth Association**

October 21 - 24, 2012

Nitra, Slovakia

IPGB SAS – organizer

[3] **Recent Advances in Neglected and Under-utilized Species Research**

October 18 - 20, 2015

Nitra, Slovakia

IPGB SAS – organizer

During evaluation period the Institute was involved in co-organisation of two international conferences, which will be held in Nitra and Bratislava in 2016:

\* **COST FA 1206 WG2 and WG4 Meeting "Ecological implications of strigolactones"** (July 20 – 22, 2016)

jointly organized by IPGB SAS and the Department of Plant Protection, Faculty of Agrobiological and Food Resources, Slovak University of Agriculture in Nitra, Slovakia  
Contact person: [radka.matusova@savba.sk](mailto:radka.matusova@savba.sk)

\* **2<sup>nd</sup> INPPO World Congress 2016 and 'Phenomen-all' COST Action FA1306** (September 4 – 8, 2016)

jointly organized by IPGB SAS, International Plant Proteomics Organization and COSTFA1306

Contact person: [martin.hajduch@savba.sk](mailto:martin.hajduch@savba.sk)

<http://www.inppo2016.sav.sk/inppo-2016>

**2.3.3. List of edited proceedings from international scientific conferences.**

- [1] **41<sup>st</sup> Annual Meeting of ESNA „Advances in Agrobiological Research and their Benefits to the Future" and international workshop „Recent Advances in Plant Biotechnology"**. Libiaková, G. - Olšovská, K. - Gajdošová, A. - Brestič, M. (Eds.), 2012. September 24-28, 2012, Stará Lesná, Slovak University of Agriculture, 150 p. ISBN 978-80-552-0855-8
- [2] **Neglected and Under-utilized Species Research in 21<sup>st</sup> Century: 6<sup>th</sup> International Conference of the European Amaranth Association**. Libiaková, G. - Gajdošová, A. - Hricová, A. (Eds.), 2012. October 21 - 24, 2012, Nitra, Ústav genetiky a biotechnológií rastlín SAV, 67 p. ISBN 978-80-970662-1-5
- [3] **Recent Advances in Neglected and Under-utilized Species Research**. Libiaková, G. - Gajdošová, A. (Eds.), 2015. October 18-20, 2015, Nitra, Ústav genetiky a biotechnológií rastlín SAV, 60 p. ISBN 978-80-970662-2-2

**2.3.4. List of journals edited/published by the institute:**

- 2.3.4.1. **WOS (IF of journals in each year of the assessment period)**
- 2.3.4.2. **SCOPUS**
- 2.3.4.3. **other databases**
- 2.3.4.4. **not included in databases**

none

- **National position of the institute**

The IPGB SAS in Nitra was established in 1990 as The Institute of Plant Genetics, aimed to solve actual problems of genetics and breeding of selected crop plant species, forest and fruit trees. Since 1998 the scientific orientation of the Institute has been extended to biotechnology and gene engineering, while its name has been changed to Institute of Plant Genetics and Biotechnology. The IPGB is the research body developing the field of plant embryogenesis, plant transformation and at present also plant proteomics on that broad scale.

The research at the IPGB is oriented towards the most topical issues of plant genetics and plant biotechnology. In the field of population genetics, the Institute, as one of the few institutions in Europe dealing also with dendrology, carries out the studies of interspecific hybridization and hybridological relations of the silver fir, with the emphasis on its resistance potential. The field experiments, established in several regions of Slovakia, extended already existing silver fir genofond, thereby making possibilities to use them for the research or breeding practice. Genetic polymorphism and biodiversity of selected forest tree species are also part of long-term research.

The genome modification of agronomically important crops, forest and fruit trees is focused on achievement of desirable traits or increased resistance against pathogens. Studies of transgene expression, factors influencing this expression as well as safety issues related to environment are in focus of research interests, too. Currently the research spans over the studies of functional genomics, namely in process of plant embryo development (zygotic, somatic and gametic), as well as in plant stress responses. The cytological, morphological, biochemical and molecular aspects of these processes as well follow.

Micropropagation and *in vitro* regeneration of selected crops and important plant species are integral part of research activities.

### **2.3.5. List of selected projects of national importance**

#### **EU Structural Funds**

[1] **Project title: Creation of Research Centre "AgroBioTech"**

Grant number: ITMS 26220220180

Principal investigator at IPGB SAS: Ján Salaj

Project duration: 04/2013 – 11/2015

Coordinator: Slovak University of Agriculture in Nitra

Number of another collaborating institutions: 2 (IPGB SAS, Constantine The Philosophe University in Nitra)

Funding (for the Organisation): 945 595 EUR

[2] **Project title: Implementation of the research of plant genetic resources and its maintaining in the sustainable management of Slovak Republic**

Grant number: 26220220097

Principal investigator at IPGB SAS: Andrej Kormuťák

Project duration: 01/2011 – 12/2014

Coordinator: Research Institute of Plant Production in Piešťany

Funding (for the Organisation): 268 128 EUR

[3] **Project title: Utilization of innovative scientific approaches for effectivity increasing in forest management**

Grant number: TT01359

Principal investigator: Andrej Kormuťák

Project duration: 03/2010 – 03/2013

Funding (for the Organisation): 9 063 EUR

**[4] Project title: Biotechnology as a tool of agronomist to deal with climatic changes (drought, raising temperature)**

Grant number: TT01326

Principal investigator: Anna Preťová

Project duration: 05/2010 – 05/2013

Funding (for the Organisation): 60 918 EUR

**7RP (7th Framework program of the European Union)**

**[5] Project title: Plant adaptation to heavy metal and radioactive pollution**

Grant number: 612587

Project duration: 01/2014 – 10/2017

Principal investigator at IPGB SAS: Martin Hajduch

Funding (for the Organisation): 37 849 EUR

**Contracted project SYNGENTA, USA - IPGB SAS**

**[6] Project title: Systematic MS<sup>E</sup>-based quantification of allergenic and celiac disease proteins in wheat grain**

Grant number: 8600006485

Project duration: 12/2010 – 12/2012

Principal investigator: Martin Hajduch

Funding (for the Organisation): 45 010 EUR

**Slovak Research and Development Agency (APVV)**

**[7] Project title: Biological diversity of wheat, improvement for adaptability under global change and use of organic agriculture**

Grant number: APVV-0197-10

Principal investigator: Ildikó Matušíková

Project duration: 05/2011 – 10/2014

Funding (for the Organisation): 38 191 EUR

**Scientific Grant Agency of Ministry of Education, Science, Research and Sport of Slovak Republic and Slovak Academy of Sciences (VEGA)**

**[8] Project title: Exploitation of modern biotechnologies in amaranth breeding programme**

Grant number: 2/0066/13

Project duration: 01/2013 – 12/2015

Principal investigator: Andrea Hricová

Coordinator: IPGB SAS

Number of another collaborating institutions: 2 (Slovak University of Agriculture in Nitra, University of Prešov in Prešov)

Funding (for the Organisation): 19 559 EUR

### 2.3.6. Projects of the Slovak Research and Development Agency (APVV)

[1] **Project title: Biological diversity of wheat, improvement for adaptability under global change and use of organic agriculture**

Grant number: APVV-0197-10

Principal investigator: Ildikó Matušíková

Project duration: 05/2011 – 10/2014

Funding (for the Organisation): 38 191 EUR

[2] **Project title: Understanding of plant adaptation in the radioactive Chernobyl area**

Grant number: APVV-0740-11

Principal investigator: Martin Hajduch

Project duration: 01/2012 – 12/2015

Number of collaborating institutions: 4

Funding (for the Organisation): 69 752 EUR

[3] **Project title: Phosphoproteomics analysis of mature seeds harvested from soybean grown in radioactive and control fields of Chernobyl area**

Grant number: SK-PT-0016-10

Principal investigator: Martin Hajduch

Project duration: 04/2012 – 12/2012

Funding (for the Organisation): 917 EUR

[4] **Project title: Assessment of genetic fidelity of *in vitro* propagated small fruits (*Rubus* and *Vaccinium* spp.)**

Grant number: SK-SRB-0033-11

Principal investigator: Alena Gajdošová

Project duration: 01/2012 – 12/2013

Funding (for the Organisation): 4 434 EUR

[5] **Project title: Clonal propagation of selected cultivars of *Rubus* and *Prunus* spp. under *in vitro* conditions**

Grant number: SK-SRB-2013-0020

Principal investigator: Alena Gajdošová

Project duration: 01/2015 – 12/2016

Funding (for the Organisation): 1 407 EUR

### 2.3.7. Projects of the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA)

[1] **Project title: Propagation *in vitro* and genetic transformation of less spread species of small fruits**

Grant number: 2/0040/11

Principal investigator: Alena Gajdošová

Project duration: 01/2011 – 12/2013

Funding (for the Organisation): 17 486 EUR

[2] **Project title: The elucidation of plant adaptation in contaminated Chernobyl area**

Grant number: 2/0126/11

Principal investigator: Martin Hajduch

Project duration: 01/2011 – 12/2013

Funding (for the Organisation): 20 539 EUR

[3] **Project title: Study of the defense responses of soybean (*Glycine max* L.) against ions of selected heavy metals**

Grant number: 2/0062/11

Principal investigator: Ildikó Matušíková

Project duration: 01/2011 – 12/2013

Funding (for the Organisation): 26 330 EUR

[4] **Project title: Development of efficient transformation and regeneration protocol of *Phelipanche ramosa* (L.) Pomel**

Grant number: 2/0139/11

Principal investigator: Radoslava Matúšová

Duration: 01/2011 – 12/2013

Funding (for the Organisation): 12 036 EUR

[5] **Project title: Exploitation of modern biotechnologies in amaranth breeding programme**

Grant number: 2/0066/13

Principal investigator: Andrea Hricová

Project duration: 01/2013 – 12/2015

Funding (for the Organisation): 19 559 EUR

[6] **Project title: Hybrid swarm populations of Scots pine and Mountain dwarf pine in Slovakia, genetic status and fertility**

Grant number: 2/0057/13 Principal investigator: Andrej Kormuťák

Project duration: 01/2013 – 12/2015

Funding (for the Organisation): 13 969 EUR

[7] **Project title: Regeneration and clonal propagation of *Rubus* and *Prunus* spp. under *in vitro* conditions**

Grant number: 2/0140/14

Principal investigator: Alena Gajdošová

Project duration: 01/2014 – 12/2016

Funding (for the Organisation): 11 569 EUR

[8] **Project title: Proteomics mapping of clinically relevant proteins in wheat grain**

Grant number: 2/0016/14

Principal investigator: Martin Hajduch

Project duration: 01/2014 – 12/2016

Funding for the Organisation: 20 656 EUR

[9] **Project title: Testing of genes for specific hydrolytic enzymes in plant transgenesis in order to use them to strengthen defence against pathogens**

Grant number: 2/0090/14

Principal investigator: Jana Libantová

Project duration: 01/2014 – 12/2016

Funding (for the Organisation): 40 926 EUR

**[10] Project title: Optimization of somatic embryogenesis in conifer trees**

Grant number: 2/0136/14

Principal investigator: Ján Salaj

Project duration: 01/2014 – 12/2016

Funding (for the Organisation): 15 317 EUR

**2.3.8. Projects of SAS Centres of Excellence**

none

**2.3.9. National projects supported by EU Structural Funds**

**[1] Project title: Utilization of innovative scientific approaches for effectivity increasing in forest management**

Grant number: TT01359

Principal investigator: Andrej Kormuťák

Project duration: 03/2010 – 03/2013

Funding (for the Organisation): 9 063 EUR

**[2] Project title: Biotechnology as a tool of agronomist to deal with climatic changes (drought, raising temperature)**

Grant number: TT01326

Principal investigator: Anna Preťová

Project duration: 05/2010 – 05/2013

Funding (for the Organisation): 60 918 EUR

**[3] Project title: Implementation of the research of plant genetic resources and its maintaining in the sustainable management of Slovak Republic**

Grant number: 26220220097

Principal investigator at IPGB SAS: Andrej Kormuťák

Project duration: 01/2011 – 12/2014

Coordinator: Research Institute of Plant Production in Piešťany

Funding (for the Organisation): 268 128 EUR

**[4] Project title: Creation of Research Centre "AgroBioTech"**

Grant number: ITMS 26220220180

Principal investigator at IPGB SAS: Ján Salaj

Project duration: 04/2013 – 11/2015

Coordinator: Slovak University of Agriculture in Nitra

Number of another collaborating institutions: 2 (IPGB SAS, Constantine The Philosopher University in Nitra)

Funding (for the Organisation): 945 595 EUR

**2.3.10. List of journals (published only in the Slovak language) edited/published by the institute:**

**2.3.10.1. WOS (IF of journals in each year of the assessment period)**

**2.3.10.2. SCOPUS**

**2.3.10.3. Other databases**

**2.3.10.4. Not included in databases**

none

- **Position of individual researchers in an international context**

**2.3.11. List of invited/keynote presentations at international conferences, as documented by programme or invitation letter**

[1] Author: **Alena Gajdošová**

Title: Clonal propagation and genetic improvement of selected small fruit species through biotechnology approaches

Event: 52<sup>nd</sup> Annual Scientific Conference „A New Approach of the Academic Research in Biology“

Date: December 11-12, 2012

Place: Bucharest, Romania

[2] Author: **Martin Hajduch**

Title: Soybean adaptation in Chernobyl area (what happen to soybean if something happen)

Event: International Symposium on Nuclear Safety

Date: March 14-15, 2013

Place: Bratislava, Slovakia

[3] Author: **Alena Gajdošová**

Title: Advances in genetic transformation of selected small fruit species

Event: 20<sup>th</sup> Symposium of the Serbian Plant Physiology Society and 1<sup>st</sup> International Conference on Plant Biology

Date: June 5, 2013

Place: Subotica, Serbia

[4] Author: **Jana Libantová**

Title: Promoters usable in marker-free transgenic plants technology

Event: Pannon Biotechnology seminars III

Date: April 15, 2013

Place: Nitra, Slovak Republic

[5] Author: **Terézia Salaj**

Title: Somatic embryogenesis of conifers – a plant regeneration system available for genetic transformation studies

Event: Pannon Biotechnology seminars III

Date: April 15, 2013

Place: Nitra, Slovak Republic

[6] Author: **Martin Hajduch**

Title: Quantitative MSE proteomics as a tool for the determination of clinically relevant proteins in wheat grain

Event: 12<sup>th</sup> Human Proteome Organization Congress

Date: September 14-18, 2013

Place: Yokohama, Japan

[7] Author: **Martin Hajduch**

Title: Seven years of plant proteomics in radio-contaminated Chernobyl area

Event: 1<sup>st</sup> INPPO World Congress on Plant Proteomics: Methodology to Biology Date: August 31-September 4, 2014

Place: Munich, Germany

### 2.3.12. List of researchers who served as members of the organising and/or programme committees

#### [1] Alena Gajdošová

- 6<sup>th</sup> International Conference of the European Amaranth Association: Neglected and Under-utilized Species Research in 21<sup>st</sup> Century (Nitra, Slovak Republic, 2012), **member of the organising and programme committee**
- 41<sup>st</sup> Annual Meeting of European Society for New Methods in Agricultural Research (Stará Lesná, Slovak Republic, 2012), **member of the organising and programme committee**
- 20<sup>th</sup> Symposium of the Serbian Plant Physiology Society and 1<sup>st</sup> International Conference on Plant Biology (Subotica-Szabadka, Serbia, 2013), **member of the programme committee**
- Recent Advances in Neglected and Under-utilized Species Research (Nitra, Slovak Republic, 2015), **member of the organising and programme committee**

#### [2] Gabriela Libiaková

- 6<sup>th</sup> International Conference of the European Amaranth Association: Neglected and Under-utilized Species Research in 21<sup>st</sup> Century (Nitra, Slovak Republic, 2012), **member of the organising and programme committee**
- 41<sup>st</sup> Annual Meeting of European Society for New Methods in Agricultural Research (Stará Lesná, Slovak Republic, 2012), **member of the organising and programme committee**
- Recent Advances in Neglected and Under-utilized Species Research (Nitra, Slovak Republic, 2015), **member of the organising and programme committee**

#### [3] Andrea Hricová

- 6<sup>th</sup> International Conference of the European Amaranth Association: Neglected and Under-utilized Species Research in 21<sup>st</sup> Century (Nitra, Slovak Republic, 2012), **member of the organising and programme committee**
- Recent Advances in Neglected and Under-utilized Species Research (Nitra, Slovak Republic, 2015), **member of the organising and programme committee**

#### [4] Ján Salaj

- 41<sup>st</sup> Annual Meeting of European Society for New Methods in Agricultural Research (Stará Lesná, Slovak Republic, 2012), **member of the organising committee**

#### [5] Terézia Salaj

- Pannon Biotechnology Seminars III. (Nitra, Slovak Republic, 2013), **member of the organising and programme committee**

- **Position of individual researchers in a national context**

### 2.3.13. List of invited/keynote presentations at national conferences, as documented by programme or invitation letter

#### [1] Author: **Andrea Hricová**

Title: Vylepšovanie genetických zdrojov láskavca pomocou mutagenézy (Improvement of amaranth genetic resources through mutagenesis)

Event: vedecká konferencia REVERSE-INTERREG IVC "Biodiverzita v poľnohospodárskej krajine a v ekosystéme"  
(scientific conference of REVERSE-INTERREG IVC "Biodiversity in agriculture and ecosystem")

Date: June 13, 2012

Place: Research Institute of Plant Production, Piešťany

[2] Author: **Jana Moravčíková**

Title: Bio-bezpečné transgénne rastliny ako nové genetické zdroje pre poľnohospodárstvo (Biosafe transgenic plants as new genetic resources for agriculture)

Event: 7. medzinárodná vedecká konferencia „Hodnotenie genetických zdrojov rastlín pre výživu a poľnohospodárstvo“

(7<sup>th</sup> international scientific conference "Evaluation of plant genetic resources for food and agriculture")

Date: May 28, 2013

Place: Research Institute of Plant Production, Piešťany

[3] Author: **Martin Hajduch**

Title: Use of quantitative MSE proteomics for the determination of allergenic proteins in wheat grain

Event: 19. vedecká konferencia s medzinárodnou účasťou "Nové poznatky z genetiky a šľachtenia poľnohospodárskych rastlín"

(19<sup>th</sup> scientific conference with international participation "New informations from genetics and crop breeding")

Date: November 19, 2013

Place: Research Institute of Plant Production, Piešťany

[4] Author: **Alena Gajdošová**

Title: Application of tissue cultures in clonal propagation of selected woody species

Event: Dendrologické dni v Arboréte Mlyňany SAV 2014: "Prostredie a vitalita drevín" (Dendrological Days in Arboretum Mlyňany SAS 2014: "Environment and vitality of woody species")

Date: September 18, 2014

Place: Arborétum Mlyňany SAS, Institute of Forest Ecology SAS, Vieska nad Žitavou

#### 2.3.14. List of researchers who served as members of organising and programme committees of national conferences

none

- **Supplementary information and/or comments documenting the international and national status of the Institute**

Several scientists from the Institute are members of editorial boards of international scientific journals, reviewers for international and domestic scientific journals. Scientists from IPGB SAS internationally recognized in their fields of research were reviewing grant proposals for international and national grant agencies (127 international grant applications in total).

In addition to numerous short term visits of foreign scientists, or visits in framework of research projects, several researchers and students visited the Institute for longer period of time. The financial support for these fellowships was obtained from international or national organisations promoting international exchange of students and scientists, based on competition:

Abdel-Salam El-Noemani, Egypt, 1 mth

Bhavin Bhat, India, 3 mth (fellowship of the Slovak Academic Information Agency - SAIA)

Gürcan Dilek, Turkiye, 1 mth

Lynlee Armstrong, Canada, 1 mth

Mariyana Gergieva, Bulgaria, 4 mth (SAIA)

Olivier Sylvian, France, 3 mth

Robert Konieczny, Poland, 2 mth (SAIA)

## 2.4. Tables of project structure, research grants and other funding resources

- **International projects and funding**

2.4.1. **Major projects within the European Research Area and other important project – Framework Programmes of the EU, ERA-NET, European Science Foundation, NATO, COST, INTAS, etc. (here and in items below please specify: type of project, title, grant number, duration, total funding and funding for the institute, responsible person in the institute and his/her status in the project, e.g. coordinator “C”, work package leader “W”, investigator “I”),**

	Project title	Type/ Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Harnessing plant reproduction for crop improvement	COST FA0903	10/2009-10/2013	13 200	"I"/Anna Preťová
	Biosafety of forest transgenic trees: improving the scientific basis for safe tree development and implementation of EU policy directives	COST FP0905	04/2010-04/2014	15 000	"I"/Terézia Salaj
	Micropropagation of conifer trees - an alternative method of plant production	COST FP0701	01/2011-05/2012	7 100	"I"/Terézia Salaj
	Studying tree responses to extreme events: a synthesis	COST FP1106	01/2011-12/2015	15 300	"I"/Andrej Kormuťák
	Plant Metabolic Engineering for High Value Products	COST FA0903	07/2011-04/2015	15 333	"I"/Jana Moravčíková
2013	Green Infrastructure approach: linking environmental with social aspects in studying and managing urban forests	COST FP1204	02/2013-02/2017	11 500	"I"/Martin Hajduch
	Strigolactones: biological roles and applications	COST FA1206	04/2013-04/2017	11 000	"I"/Radoslava Matúšová
	Pathogen-informed strategies for sustainable broad-spectrum crop resistance	COST FA1208	05/2013-04/2017	11 000	"I"/Jana Libantová
2014	Plant adaptation to heavy metal and radioactive pollution	7RP/612587	01/2014-10/2017	37 849	"C"/Martin Hajduch
	The quest for tolerant varieties - Phenotyping at plant and cellular level	COST FA1306	05/2014-05/2018	6 000	"I"/Terézia Salaj
	Non-native tree species for European forests - experiences, risks and opportunities	COST FP1403	06/2014-05/2018	1 300	"I"/Andrej Kormuťák
2015					

2.4.2. **Other international projects, incl. total funding and funding for the institute**

2.4.3. **Other important, international projects and collaborations without direct funding (max. 10 projects)**

- **National projects and their funding**

**2.4.4. Projects supported by the Slovak Research and Development Agency (APVV)**

Role of the Institute e.g. coordinator "C", investigator "I".

	Project title	Type / Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute / Responsible person
2012	Biological diversity of wheat, improvement for adaptability under global change and use of organic agriculture	APVV-0197-10	05/2011-10/2014	38 191	"I"/Ildikó Matušiková
	Phosphoproteomics analysis of mature seeds harvested from soybean grown in radioactive and control fields of Chernobyl area	SK-PT-0016-10	04/2012-12/2012	917	"I"/Martin Hajduch
	Assessment of genetic fidelity of <i>in vitro</i> propagated small fruits (Rubus and Vaccinium spp.)	SK-SRB-0033-11	01/2012-12/2013	4 334	"I"/Alena Gajdošová
	Understanding of plant adaptation in the radioactive Chernobyl area	APVV-0740-11	07/2012-12/2015	69 752	"C"/Martin Hajduch
2013					
2014					
2015	Clonal propagation of selected cultivars of Rubus and Prunus spp. under <i>in vitro</i> conditions	SK-SRB-2013-0020	01/2015-12/2016	1 407	"I"/Alena Gajdošová

**2.4.5. 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	2012	2013	2014	2015
Number	7	8	7	6
Funding in the year (EUR)	53613	62018	60430	55019 <sup>1</sup>

<sup>1</sup> Excluding projects for the popularisation of science

- **Summary of funding from external resources**
  - 2.4.6. List of projects supported by EU Structural Funds**
    - [1] **Project title: Utilization of innovative scientific approaches for effectivity increasing in forest management**  
 Grant number: TT01359  
 Principal investigator: Andrej Kormuťák  
 Project duration: 03/2010 – 03/2013  
 Funding (for the Organisation): 9 063 EUR
    - [2] **Project title: Biotechnology as a tool of agronomist to deal with climatic changes (drought, raising temperature)**  
 Grant number: TT01326  
 Principal investigator: Anna Preťová  
 Project duration: 05/2010 – 05/2013  
 Funding (for the Organisation): 60 918 EUR
    - [3] **Project title: Implementation of the research of plant genetic resources and its maintaining in the sustainable management of Slovak Republic**  
 Grant number: 26220220097  
 Principal investigator at IPGB SAS: Andrej Kormuťák  
 Project duration: 01/2011 – 12/2014  
 Coordinator: Research Institute of Plant Production in Piešťany  
 Funding (for the Organisation): 268 128 EUR
    - [4] **Project title: Creation of Research Centre "AgroBioTech"**  
 Grant number: ITMS 26220220180  
 Principal investigator at IPGB SAS: Ján Salaj  
 Project duration: 04/2013 – 11/2015  
 Coordinator: Slovak University of Agriculture in Nitra  
 Number of another collaborating institutions: 2 (IPGB SAS, Constantine The Philosopher University in Nitra)  
 Funding (for the Organisation): 945 595 EUR
  - 2.4.7. Summary of external resources of the EU Structural Funds (ERDF/ESF)**  
 Role of the Institute in the project, e.g. coordinator "C", work package leader "W", investigator "I".

Year	Project title	Type/Project number	Duration in months	Funding for the Institute (EUR)	Role of the Institute/Responsible person
2012	Utilization of innovative scientific approaches for effectivity increasing in forest management	EU SF	03/2010-03/2013	9 063	"C"/Andrej Kormuťák
	Biotechnology as a tool of agronomist to deal with climatic changes (drought, raising temperature)	EU SF	05/2010-05/2013	60 918	"C"/Anna Preťová
	Implementation of the research of plant genetic resources and its maintaining in the sustainable management of Slovak Republic	EU SF	01/2011-12/2014	268 128	"I"/Andrej Kormuťák
2013	Creation of Research Centre "Agrobiotech"	EU SF	04/2013-11/2015	945 595	"I"/Ján Salaj
2014					
2015					

External resources	2012	2013	2014	2015	total	average
External resources (milions of EUR)	0,347	0,034	0,026	0,725	1,131	0,283
External resources transferred to cooperating research institute (milions of EUR)	0,000	0,000	0,000	0,000	0,000	0,000

- **Supplementary information and/or comments on research projects and funding sources**

## 2.5. PhD studies and educational activities

### 2.5.1. List of accredited programmes of doctoral studies, period of validity

- [1] **4.2.4. genetics**, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Nitra, Slovak Republic (2014 – 2016)
- [2] **5.2.25. biotechnologies**, Faculty of Natural Sciences, Comenius University, Bratislava, Slovak Republic (2010 – 2016)
- [3] **5.2.25. biotechnologies**, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Nitra, Slovak Republic (2010 – 2016)

*This programme was changed to new accredited programme **6.1.18. agrobiotechnologies** (2016 – 2020).*

**2.5.2. Summary table on doctoral studies (number of internal/external PhD students; number of foreign PhD students, number of students who successfully completed their theses, number of PhD students who quit the programme)**

PhD study	31.12.2012			31.12.2013			31.12.2014			31.12.2015		
Number of potential PhD supervisors	14			13			13			11		
PhD students	number	defended thesis	students quitted									
Internal	12,0	1,0	0,0	13,0	3,0	0,0	10,0	2,0	0,0	10,0	4,0	0,0
External	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Other supervised by the research employees of the institute	4,0	1,0	0,0	4,0	2,0	0,0	3,0	0,0	0,0	4,0	1,0	0,0

**2.5.3. Summary table on educational activities**

Teaching	2012	2013	2014	2015
Lectures (hours/year) <sup>2</sup>	64	92	86	65
Practicum courses (hours/year) <sup>2</sup>	72	230	172	106
Supervised bachelor theses (in total)	2	1	1	2
Supervised diploma theses (in total)	4	7	7	9
Supervised PhD theses (in total)	16	17	13	14
Members in PhD committees (in total)	5	5	6	6
Members in DrSc. committees (in total)	2	0	2	2
Members in university/faculty councils (in total)	1	1	1	1
Members in habilitation/inauguration committees (in total)	1	1	2	1

2

**2.5.4. List of published university textbooks**

- [1] GÁLOVÁ, Zdenka - BALÁŽOVÁ, Želmíra - CHRENEK, P. - CHŇAPEK, Milan - LIBANTOVÁ, Jana - MATUŠÍKOVÁ, Ildikó - MORAVČÍKOVÁ, Jana - SALAJ, Ján - DRÁBEKOVÁ, Janka. Metódy a techniky génových manipulácií. [Methods and techniques of genetic manipulation, In Slovak]. Nitra: Slovenská poľnohospodárska univerzita, 2013. ISBN 978-80-522-1092-6.

<sup>2</sup> Do not include time spent with bachelor, diploma or PhD students during their supervising

### 2.5.5. Number of published academic course books

- [1] GÁLOVÁ, Zdenka - SALAJ, Ján - MATUŠÍKOVÁ, Ildikó. Molekulárna biológia. [Molecular biology, Slovak]. Nitra: Slovenská poľnohospodárska univerzita, 2012. 166 s. ISBN 978-80-552-0913-5.

### 2.5.6. List of joint research laboratories/facilities with universities

- [1] Prešov university in Prešov (2011 – present)  
[2] Slovak University of Agriculture in Nitra, Constantine the Philosopher University in Nitra (in the frame of the regional centre of applied research and development in the field of Agro-Bio-Technologies “AgroBioTech”; 2013 – present)

#### • **Supplementary information and/or comments on doctoral studies and educational activities**

Doctoral study at IPGB, as external educational institution, includes active participation of PhD. students in scientific conferences, publishing in respected international journals with peer review and cooperation with other research groups. Students are expected to carry out portions of their PhD. training and research in foreign countries, as a part of the expanding international flow of doctoral students worldwide. Internationalizing the PhD. study would help to expand a graduate's professional networks and employability. At the institutional level, it increases the visibility and exposure of the Institute globally, but helps also specify current research priority areas.

PhD. student mobility involved in assessed period mainly the National Scholarship Programme of the Slovak Republic (NSP) financed by the Ministry of Education, Science, Research and Sport of the Slovak Republic and arranged by Slovak Academic Information Agency (SAIA).

#### **List of outgoing and incoming PhD. student mobility (more than 2 weeks) during assessed period:**

- [1] Miroslava Súkeníková, Austria (2 mth, SAIA/NSP)  
[2] Michal Berčák, Portugal (1 mth)  
[3] Daša Gábrišová, Taiwan (1,5 mth)  
[4] Marína Maglovski, Switzerland (6 mth SAIA/NSP +2 mth payed by overseas institution)  
[5] Veronika Lancíková, USA (6 mth SAIA/NSP)

- [1] Bhavin Bhat, India (3 mth, SAIA/NSP)  
[2] Olivier Sylvian, France (3 mth)  
[3] Shashi Kant Sigh, Taiwan (2 wk)  
[4] Yulia Krasylenko, Ukraine (1 mth, SAIA/NSP)  
[5] Olena Nesterenko, Ukraine (3 mth 7 RP/IRSES + 2 weeks SAIA/NSP)  
[6] Ecem Sancar, Turkye (3 wk, 7 RP/IRSES)  
[7] Olena Klymenko, Ukraine (2 mth, 7 RP/IRSES)  
[8] Maryia Makavitskaya, Belorussia (3 mth, 7 RP/IRSES)  
[9] Mariyana Gergieva, Bulgaria (4 mth, SAIA/NSP)

## 2.6. Social impact

### 2.6.1. List of the most important results of applied research projects. Max. 10 items

[1] **Project title: Utilization of innovative scientific approaches for effectivity increasing in forest management**

Grant number: TT01359

Project duration: 03/2010 – 03/2013

Principal investigator: Andrej Kormuťák

Revenues and funding for organization in 2012: SF EU - 0 EUR

in 2013: SF EU - 9 063 EUR

The project results: Unlike standard scientific projects popularisation projects are focused on their immediate social impact – to raise the awareness and interest in the presented topic by a target group. The project accomplished this aim of key importance by sparking off the debate on official, public open, project's website ([www.efles.sk](http://www.efles.sk), active till end of 2015). Subjects discussed on-line were related mainly to advanced research methods in the area of forest trees, forest ecology, forest tree propagation and establishment of forest tree nursery. On the project web page the monograph "Utilization of innovative scientific approaches for effectivity increasing in forest management" was published with unrestricted access. During the project several education seminars were carried out and the strong interest in the said topics was shown also by seminar participants.

The published monograph was distributed to the libraries, universities, the relevant institutions e.g., the Slovak Agriculture and Food Chamber, the Slovak Forestry Company, the Agricultural Paying Agency, to the persons interested in discussed topics etc.

[2] **Project title: Biotechnologies as a tool of advanced agriculture for overcoming of anticipated climatic changes (drought, increasing temperature)**

Grant number: TT01326

Project duration: 05/2010 – 05/2013

Principal investigator: Anna Preťová

Revenues and funding for organization in 2012: SF EU - 53 115 EUR

in 2013: SF EU - 7 803 EUR

Likewise for above mentioned project: extensive general discussion forum was opened on-line (through web page [www.biopole.sk](http://www.biopole.sk), active until 2015), but also during education seminars. The mission of seminars was to disseminate accomplished research results and to inform about advanced plant biotechnology methods applicable in agriculture, that could help to increase the quality and quantity of crop production under ongoing dramatic climatic changes. Generally positive attitude towards presented topics, including controversial GM techniques, was shown by a target group – crop growers, farmers, breeders and representatives of the agricultural cooperatives.

The monograph "Biotechnologies as a tool of advanced agriculture for overcoming of anticipated climatic changes (drought, increasing temperature)" was freely available on the web page, but also distributed to seminar participants, to the libraries, universities and to relevant institutions like the Slovak Agriculture and Food Chamber, the Agricultural Paying Agency as well as to persons interested in the topics.

[3] **Project title: Exploitation of modern biotechnologies in amaranth breeding programme**

Grant number: 2/0066/13

Project duration: 01/2013 – 12/2015

Principal investigator: Andrea Hricová

Revenues and funding for organization in 2013: VEGA - 3 864 EUR

in 2014: VEGA - 7 736 EUR

in 2015: VEGA - 8 346 EUR

The project results: The large collection of previously irradiation-obtained mutants of naturally gluten-free amaranth (*Amaranthus* spp.) has been extensively studied on genetic, biochemical and molecular level using modern bio and -omics technologies. Several mutants showed advanced phenotype and improved quantity and quality traits. Thus, these mutant lines represent valuable germplasm resource and breeding material.

Most important result of this applied research is registration of the first Slovak grain amaranth (*Amaranthus cruentus* L.) variety 'PRIBINA', bred by IPGB SAS in cooperation with the Department of Ecology (Prešov University in Prešov, SK). New variety is distinguished by a genetically fixed high 1000-seed weight, important yield element, and high nutrition quality. Currently, application for protection of this variety is in progress.

The IPGB received positive feedback on registration of new variety and breeding certificate from **the company SEMIGO EUROPE s.r.o., Olomouc, the Czech Republic** (executive director Ing. Kristina Slezáková). One of the activities of SEMIGO EUROPE s.r.o. is provision and distribution of seed stocks to growers and farmers over the world. The company showed **interest to purchase the Variety License of variety 'PRIBINA'**. At present, we are in process to conclude a standard Variety License Agreement under co-ordination of the Office for Technology and Knowledge transfer and the Protection of Intellectual Property of SAS.

Simultaneously, another selected mutant line of interspecific amaranth hybrid is tested in the state variety field trial (DUS tests) with purpose to be registered as a next Slovak amaranth variety.

#### [4] **Project title: Creation of Research Centre “AgroBioTech”**

Grant number: ITMS 26220220180

Project duration: 04/2013 – 11/2015

Principal investigator: Ján Salaj

Revenues and funding for organization in 2013: EU SF - 0 EUR

in 2014: EU SF - 7 639 EUR

in 2015: EU SF - 937 956 EUR

The project results: Transfer of knowledge and technologies from the field of plant biotechnology and genetics and their implementation in agricultural praxis and breeding is possibility for communication between researchers and consumers. Thus, the primary idea behind the project was to create conditions for intensive collaboration with social and economic praxis.

The main result was establishment of the innovation, regional competent centre of applied research and development in the field of Agro-Bio-Technologies (AgroBioTech). The innovation centre integrates the excellent applied research through partnership with Slovak University of Agriculture in Nitra (project coordinator), the Constantine the Philosopher University in Nitra and the IPGB SAS, where centre is partially located. Three new laboratories were build up and equipped with the modern infrastructure in the frame of “AgroBioTech” at the Institute: two Laboratories of Reproduction and Developmental Biology and one Laboratory of Plant Molecular Breeding.

In the scope of application of the results achieved by experimental biotechnology in framework of this project, impressive achievements were accomplished at IPGB SAS: firstly, **creation of new valuable amaranth genotypes** - first Slovak amaranth variety “Pribina”; another amaranth hybrid mutant line under the DUS tests and several other

mutants with increased seed size and seed weight that are under study). The introduction of these improved amaranth genotypes into agricultural production will contribute to the sustainable agriculture, maintenance of biological diversity and food safety. The reaction on the released variety "Pribina" was **the demand for seed stock from the side of small farmers in Slovakia**: agricultural cooperative PD Zahradne (Ing. Gall, phone 00421 905 366 337) and agricultural cooperative PD Kapušany (Ing. Poláček, phone 00421 918575683), with the aim of seed stock propagation in a larger scale in order to produce sufficient amount of seed stock for selling.

**Elaboration of effective protocols for large-scale micropropagation of selected small fruit species**, such as *Vaccinium*, *Rubus* and *Amelanchier* spp., was another objective of this project. The reaction of target group (fruit growers, small farmers) on this output was very positive. **Intensive collaboration with company Wellberry s.r.o.** was created. Wellberry provides the mother plants for *in vitro* culture establishment and *in vitro*-obtained plant material from experiments is given to the company for further testing in the field conditions. The aim of this collaboration in the future is establishment of privat *in vitro* laboratory at the IPGB in context of changing the Institute form on public research institution. The interest of another blueberry growers – **company Ekoprogram (Nová Baňa, SK) and Blueberry Plantation Pánis (Rudnianská Lehota, SK)** was initiated and possibility of consultations has been discussed.

[5] **Project title: Hybrid swarm populations of Scots pine and Mountain dwarf pine in Slovakia, genetic status and fertility**

Grant number: 2/0057/13

Project duration: 01/2013 – 12/2015

Principal investigator: Andrej Kormuťák

Revenues and funding organization in 2013: VEGA - 6 228 EUR

in 2014: VEGA - 5 159 EUR

in 2015: VEGA - 2 840 EUR

The project results: The project was oriented on molecular analysis of the putative hybrid swarms of Scot pine and Mountain dwarf pine occurring in the North Orava region (Slovakia) using simultaneous analysis of the chloroplast DNA (cpDNA) and mitochondrial DNA (mtDNA) of individual trees.

As a result, hybrid nature of swarms was confirmed. The quantification of the proportions of both hybrid individuals and pure species individuals of *Pinus sylvestris* and *P. mugo* was done on tested localities, as well as the assessment of genetic structure of the putative hybrid swarms aiming at description the degree of their divergency from control populations of the parental species. The crossability of *P. sylvestris* and *P. mugo* was tested in the field, too. Fertility of hybrid swarms and parental species was compared with regard to seed quality.

It is known that high bioersivity of forest populations can ensure the higher viability and stability of the forest ecosystems in the changing environmental conditions. Therefore, the knowledge on genetic diversity of populations has important application in the forest management.

[6] **Project title: Proteomic mapping of clinically relevant proteins in wheat grain**

Grant number: 2/0016/14

Project duration: -

Principal investigator: Martin Hajduch

Revenues and funding organization in 2014: VEGA - 11 560 EUR

in 2015: VEGA - 9 674 EUR

The project results: The result of the project was the establishment of 2-DE quantitative

map of clinically relevant proteins (proteins causing allergic asthma, dermatitis, celiac disease or gluten-sensitive enteropathy) in wheat grain of cv. Viginta. The protein map was developed by combination of the 2-DE electrophoresis and mass spectrometry. This determination method provides more robust characterization of wheat grain proteins in comparison with quantitative methods based on immunology techniques which are mostly used.

In recent years, big attention is paid to the prevalence of food allergies. It is estimated that 2 - 4 % of mature population and 6 % of children are suffering from different types of food allergy. From this point of view, this robust determination method has a high potential for application in allergen detection in food chain.

**[7] Project title: Strigolactones: biological roles and applications**

Grant number: COST FA1206

Project duration: 04/2013 – 04/2017

Principal investigator: Radoslava Matúšová

Revenues and funding organization in 2013: EU, SAS - 3 000 EUR

in 2014: EU, SAS - 4 000 EUR

in 2015: EU, SAS - 4 000 EUR

The project results: In collaboration with COST partners from Israel (Weizmann Institute of Science, Rehovot), simple „high- throughput” screening method for testing of large library of chemical substances as well as substances isolated from plants was developed. This method enables the testing of high number of substances for induction of parasitic plant seed germination (*Phelipanche* spp. and *Orobanch* spp.) in a relatively short time. The regulation of parasitic plant seed germination enables creation of new strategies in the fight with parasitic plants.

By implementation of this robust (qualitative) method, large number of compounds was screened for initiation of seed germination of the selected parasitic plants. The library available at the Weizmann Institute of Science contains 3450 metabolites and is very diverse in terms of chemical structures. We identified several compounds that induce germination of parasitic weeds (*Orobanch cumana* or *Phelipanche aegyptiaca*). The identified hit compounds will serve a base for further investigation. We will study in more details effectivity of identified compounds in primary screen to distinguish compounds with strong or weak ability for observed phenotype (induction of germination) of tested parasitic weed species. Other parasitic weed species will be screened as well. Based on candidate compounds characteristics, the strategy for molecular target identification, and practical application in agriculture, will be suggested.

**2.6.2. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign institutes**

**[1] Expertise (2014): Expert’s report elaboration of the correctness of the risk assessment for specific GMO for placing on the market**

Expertise addressee: Commission for Biological Security, Ministry of Environment of the Slovak Republic

Elaborated by: Jana Libantová

Brief description: Study of the materials, elaboration of reports. This activity results from membership in the board of experts of the Commission for Biological Safety. It is aimed at expert’s reports elaboration as a basis for making recommendations of the Commission on Biosafety for applications and notifications relating to the use of genetic technologies and genetically modified organisms under the Act 151/2002.

### 2.6.3. List of contracts and research projects with industrial and other commercial partners, incl. revenues

- [1] **Memorandum of Agreement** between IPGB SAS, Nitra, Slovakia and **Syngenta Biotechnology, Inc., North Carolina, USA** on research project entitled "Systematic MS<sup>E</sup> based quantification of allergenic and celiac disease proteins in wheat grain".

Project duration: 12/2010 – 12/2012

Responsible person: Martin Hajduch

Revenues and funding organization in 2012: Syngenta - 45 010 EUR

- [2] **Contract** between IPGB SAS, Nitra, Slovakia and **the Research Institute of Plant Production, Piešťany, Slovakia** on research project entitled "Implementation of plant genetic resources research and its support in sustainable development of economy of Slovak Republic".

Project duration: 01/2011 – 12/2014

Project number: 26220220097

Responsible person: Andrej Kormuťák

Revenues and funding organization in 2012: SF EU - 243 939 EUR

in 2013: SF EU - 5 835 EUR

in 2014: SF EU - 10 979 EUR

in 2015: SF EU - 7 375 EUR

- [3] **Contract cooperation** between IPGB SAS, Nitra, Slovakia and **company Wellberry, s.r.o., Slovakia.**

Brief description: The contract matter of a reciprocal beneficial agreement is cooperation in the area of propagation of selected small fruit species and testing of their adaptability under conditions of Slovakia. The purpose of cooperation is resolve current research tasks more effectively and apply achieved results in practice. The partner institution asked the IPGB SAS to compile comprehensive study of growing of berry fruits in cadaster of village SUCHÁŇ ("Growing of berry fruits Wellberry s.r.o. in cadaster of village SUCHÁŇ", 2014; in Slovak).

Contract duration: 2011 – present

Revenues: 0 EUR

- [4] **Contract cooperation** between IPGB SAS, Nitra, Slovakia and **the National Forest Centre in Zvolen, Slovakia.**

Brief description: The contract matter is cooperation in the area of practical utilization of the results of artificial hybridisation of *Abies* spp. The National Forest Centre established the permanent research areas in Prešov district, locality Hertník and Čadca district, locality Husárik with the aim of continuous monitoring and evaluation of growth characteristics and resistance potential one of the hybrids obtained by IPGB SAS and provided to the National Forest Centre.

Contract duration: 2011 – present

Revenues: 0 EUR

### 2.6.4. List of licences sold abroad and in Slovakia, incl. revenues

none

### **2.6.5. List of most important social discourses under the leadership or with significant participation of the institute (max. 10 items)**

**[1] Jana Libantová**

Member of Expert assembly at Commission for Biological Security of the Ministry of Environment SR (2008 – exists)

**[2] Anna Pret'ová**

Member of Expert assembly at Commission for Biological Security of the Ministry of Environment SR (2008 – exists)

**[3] Ján Salaj**

Member of the Slovak Research and Developmental Agency – Working Group for Natural Sciences 4 (2011 – 2014)

**[4] Radoslava Matúšová**

1 project evaluation for The United States – Israel Binational Agricultural Research and Development Fund (BARD; 2012)

**[5] Martin Hajduch**

1 project evaluation for National Science Centre, Poland (2013)

1 project evaluation for R&D Excellence awards, Kentucky Science and Engineering Foundation, USA (2013)

3 project evaluations for The PRIME-XS Consortium (2013, 2014)

3 project evaluations for Czech-Norwegian Research Programme CZ09 (2014)

**[6] Anna Pret'ová**

Member of Life Panel of FP7 - PEOPLE - 2013 - Individual postdoctoral fellowships (evaluation of 92 projects – 21 in 2012, 48 in 2013, 23 in 2014)

24 project evaluation for Czech-Norwegian Research Programme CZ09 (2014)

**[7] Andrej Kormuťák**

Chair of Commission for Defenses of Doctoral Dissertation Thesis/Dr.Sc. (2010 – 2015)

**[8] Ján Salaj**

Chair of Commission for Defenses of Doctoral Dissertation Thesis/Dr.Sc. (04/2015 – 2020)

### **2.6.6. Summary of relevant activities, max. 300 words**

In the framework of project Creation of Research Centre "AgroBioTech" which is oriented on the transfer of knowledge and technologies "from the laboratories into agricultural praxis", the detailed conceptions of the new laboratories created during projects have been elaborated (Conceptions of Laboratories of Reproduction and Developmental Biology and Laboratory of Plant Molecular Breeding). On the basis of these conceptions, the "Offer leaflets for partnership and cooperation" have been formulated (in Slovak and English languages) in which the research activities of the mentioned laboratories are presented in a concise form designed for MSP-CONSULT, s.r.o., Slovakia (Business consulting company) and foreign partners.

The offer leaflet templates were prepared according to the recommendation of Slovak Liaison Office for Research and Development in Brussels and will be used for propagation of laboratories by posters and information portal with the aim to improve involvement of the Institute into EU research and development programmes and into cooperation with industrial and research bodies in Slovakia and abroad.

The “Offer leaflets for partnership and cooperation” can be found at:  
[http://pribina.savba.sk/ugbr/index.php/fondy\\_I/](http://pribina.savba.sk/ugbr/index.php/fondy_I/)

## **2.7. Popularisation of Science (outreach activities)**

### **2.7.1. List of the most important popularisation activities, max. 20 items**

#### **TV broadcasts**

[1] TA3/SR (Martin Hajduch, 2012)

[2] RTVS/SR (Andrea Hricová, 2012)

#### **radio broadcasts**

[3] VIVA/SR (Andrea Hricová, 2012)

[4] Regina/SR (Martin Hajduch, 2013)

[5] RTVS/SR (Martin Hajduch, 2014)

[6] RTVS/SR (Jana Libantová, 2015)

#### **newspapers appearance**

[7] Pravda/SR (Martin Hajduch, 2012)

[8] SME/SR (Martin Hajduch, 2012)

[9] SME/SR (Martin Hajduch, 2014)

[10] Prešovský KORZÁR/SR (Alena Gajdošová, Andrea Hricová, Gabriela Libiaková, 2015)

[11] Prešporský podnikateľ/SR (Alena Gajdošová, Andrea Hricová, Gabriela Libiaková, 2015)

#### **exhibitions (panel presentation)**

[12] International agricultural exhibition “Agrokomplex 2012” (Jana Libantová, Dominika Durechová, 2012)

[13] International agricultural exhibition “Agrokomplex 2013” (Soňa Fekecsová, Ľubica Uváčková, Katarína Klubicová, Martin Hajduch, 2013)

[14] International agricultural exhibition “Agrokomplex 2014” (Andrea Hricová, Alena Gajdošová, Gabriela Libiaková, 2015)

[15] International agricultural exhibition “Agrokomplex 2015” (Andrea Hricová, Alena Gajdošová, Gabriela Libiaková, 2015)

[16] International agricultural exhibition “Agrokomplex 2015” (Radoslava Matúšová)

#### **others**

[17] lecture at Astrofilm (Martin Hajduch, 2013)

[18] internet article/www.tech.sme.sk (Jana Libantová, 2013)

[19] excursion of secondary school students at IPGB (Andrea Hricová, 2014)

[20] lecture at European Researchers' Night (Jana Moravčíková, Martin Hajduch, 2015)

## 2.7.2. Table of outreach activities according to institute annual reports

Outreach activities	2012	2013	2014	2015	total
Articles in press media/internet popularising results of science, in particular those achieved by the Institute	8	13	5	2	28
Appearances in telecommunication media popularising results of science, in particular those achieved by the Institute	3	1	2	1	7
Public popularisation lectures	18	6	0	3	27

- **Supplementary information and/or comments on popularisation activities, max. 300 words**

The Institute is annually involved in “**Open Day**” organized in the frame of **European week of science** for public (lectures and panel presentations mainly for scholars and university students).

## 2.8. Background and management. Human resources and implementation of recommendations from previous assessment

### 2.8.1. Summary table of personnel

Personnel	2012	2013	2014	2015
All personnel	43,0	41,0	39,0	39,0
Research employees from Tab. Research staff	23,0	21,0	20,0	19,0
FTE from Tab. Research staff	19,510	19,780	15,850	14,770
Average age of research employees with university degree	44,6	46,5	48,0	45,6

#### 2.8.1.1. Professional qualification structure (as of 31.12. 2015) FEMALE

FEMALE	AGE									
	Number of	< 30	31 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	> 65
DrSc. / prof.									1	
II.a / Assoc. prof.				2	1	2	2			
Other researchers PhD./CSc.	1		1	1						
doc. / Assoc. prof.										

### 2.8.1.2. Professional qualification structure (as of 31.12. 2015) MALE

MALE	AGE									
	Number of	< 30	31 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	> 65
DrSc. / prof.				1		1			1	1
II.a / Assoc. prof.										
Other researchers PhD./CSc.	2	2								
doc. / Assoc. prof.										

### 2.8.2. Postdoctoral and mobility scheme

#### 2.8.2.1. Postdoctoral positions supported by national and international resources

none

#### 2.8.2.2. Postdoctoral positions supported by external funding

none

#### 2.8.2.3. SAS stipends and SASPRO stipends

none

#### 2.8.2.4. Internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

##### [1] Eva Boszorádová

01/01/2009 – 31/12/2012 (from 10/06/2011 interrupted because of maternity leave, will continue starting 09/2016)

##### [2] Katarína Klubíková

01/01/2012 – 31/12/2015

##### [3] Martin Jopčík

01/01/2016 – 31/12/2019

### 2.8.3. Important research infrastructure (max. 2 pages)

Within the last 15 years the Institute has been gradually furnished with all basic laboratory equipment needed for *in vitro* culture work and molecular biology analyses. It involved sterilizers, sterile boxes with HEPA filters, Biohazard boxes, cultivation rooms, greenhouse, stereomicroscope equipped with a UV lamp (Leica), fluorescent microscope Axioplan 2 (Zeiss), automatized analyzer of fluorescently labelled DNA (ABI Prism 310, Applied Biosystems, USA) with the software for analyses of DNA polymorphisms (SSR, AFLP, microsatellites), electrophoretic units, thermocyclers, transluminator UVP, UV lamp BioDoc., IT system + UVP camera, laboratory shakers, deep freezer, automatic photo equipment, Microtome, etc.

Nevertheless, a **significant amount of new instruments was acquired** in the frame of **two projects co-financed by EU**: (1) Implementation of research of plant genetic resources and its support in sustainable development of Slovak Republic (2011-2014) and (2) Creation of Research Centre "AgroBioTech" (2013-2015).

At the Department of Molecular Biology and Biotechnology are available: **thermocycler -TProfessional Basic Gradient** (Biometra); Tetrad Thermal cyler - PTC-0240G DNA Engine (Bio-Rad Laboratories Ltd.), the UV VIS Spectrophotometer - UV-

1800 and UV-VIS Spectrophotometer (Shimadzu), BioSpec-nano (Shimadzu), Deep Freezer UxF300 (Revco), a tissue homogenizer - TissueLyser (Qiagen GmbH), a cooled centrifuge - Rotina 380R (Hettich GmbH), **thermocycler qPCR** – LihtCycler Nano (Roche), Laminar Flow Cabinet Biohazard Big with accessories - Bio II Advance 6 (Telstar), Laboratory Shaker incubated with accessories with cooling system – Excella E24R (New Brunswick), Autoclaves (horizontal and portable), etc.

**Department of Developmental and Reproductive Biology** is equipped for entire “gel-based” and “gel-free” proteomics workflow, including extensive bioinformatics and processing of “raw files” from **Mass spectrometers Q-TOF Premiere (LC-MS/MS, Waters), MALDI-TOF/TOF (Brukers)** located at the MS Centre in Bratislava (Institute of Virology, Slovak Academy of Sciences). The equipment for protein two-dimensional electrophoresis (2-DE) is available directly at the Institute. This includes: 2-DE apparatus, **High-resolution scanner/densitometer GS 800 Densitometer (Bio-Rad), PD Quest software**, stains for detection of protein posttranslational modifications (for instance ProQDiamond for detection of protein phosphorylation), Concentrator with rotor - SPEEDVAC (Eppendorf). In our workflow, the samples, after their digestion with trypsin (or other enzyme, like chemotrypsin) are analyzed at the MS Centre in Bratislava and resulted “raw data” are processed at IPGB using 64 bit workstation (DELL), with corresponding **software ProteinLynx (Q-TOF) and ProteinScope (MALDI-TOF/TOF)**, that is directly connected to both MS instruments via high speed internet connection. Very important acquisition present **two SEPARATION UNIT – Ettan DALT Six (GE Healthcare), LASER SCANNER - Typhoon FLA 9500 (GE Healthcare)**.

**Department of Population Genetics and Breeding** is equipped with **automatized analyzer of fluorescently labelled DNA** - ABI Prism 310 (Applied Biosystems) **with the software** for analyses of DNA polymorphisms (SSR, AFLP, microsatellites) and DNA isolator - Maxwell 16 (Omega), **Stereomicroscop fluorescent with accessories** – MZ 10F (Leica).

Three laboratories of this Department (two Laboratories of Reproduction and Developmental Biology and one Laboratory of Plant Molecular Breeding) were completely reconstructed and supplemented by new instruments: **Growth chamber with climatization – ICH 750 (Memmert), Thermocycler gradient - SureCycler 8800** (Agilent Technologies), Water purification system – Simplicity UV (Merck Millipore), **Photodocumentation system – Gel Doc It 2 310** (UVP), three pieces of LaminarFlow cabinets Biohazard – Bio II Advance 6 (Telstar), Laboratory shaker incubated with cooling system – Excella E24R (New Brunswick), Laboratory dishwasher – G 7893, Rodem (Miele), Laboratory dryer - UF 110 (Memmert), Centrifuge benchtop refrigerated –5418R, 5424R (Eppendorf), Autoclaves (horizontal and portable) - Prestige Classic Media 12 I (Prestige Medical), two pieces of autoclave horizontal, Analytical balance electronical digital – AEJ 200-4NM (Kern) etc.

One of four completely reconstructed *in vitro* rooms was supplemented with Laboratory shaker for plant cultivation with accessories – advanced 10000-2 (VWR) Collection.

At the IPGB all laboratories and offices are connected with local internet network (LAN) which is connected with Slovak academic network (SANET) by optical cable. Due to this network our institute has very fast on-line connection with the libraries, research institutes and universities around the world. Altogether, there are 50 PCs available at the IPGB so all researchers and PhD students can use computers independently. In addition, a few PCs are on disposal for our guests and graduate students. Our institute is also responsible for management of server and LAN for other academic organizations located in the academic campus in Nitra.

A necessary prerequisite for obtaining valuable scientific outputs is always an appropriate and modern research infrastructure. All research infrastructure and the laboratory equipment obtained during the assessment period is regularly used by employees of the Institute and, if necessary, by project partners. The infrastructure acquired in the frame of mutual project “AgroBioTech” is on disposal to project partners

from the Slovak University of Agriculture and The University of Constantine the Philosopher in Nitra (and vice versa) according to the EU SF rules.

**Note: the instruments and softwares of the highest significance are written in bold.**

#### **2.8.4. Description of how the results and suggestions of the previous assessment were taken into account**

- 1. Comments from the previous assessment:** *“To consider preparation of concept of research strategy and institute development for the future. Too diverse topics constitute the present research; concentration on less topics would make the research more competitive (research seems to be too particularized as seen also from an extended bilateral collaboration, almost each aimed at different topic; research strategy is not clear from the mission of the Institute; many diverse topics; absence of the identification of main themes).”*

Based on the recommendations of the Commission of the last evaluation following measures were adopted by management of Institute:

- a) to avoid crumbling of research activities the scientific goals/proposal for next assessment period have been focused on two main topics – genetic and molecular aspects of plant resistance to abiotic and biotic stress and improving the growth and quality of crops and forest trees using different molecular genetic, proteomic and biotechnological approaches (for details see Research strategy)
- b) the research activities dealing with *in vitro* technologies have been narrowed only to somatic embryogenesis and micropropagation of woody plants
- c) in the context of organization changes at the Institute the Department of Cell Biology was cancelled and submission of research project focused on cell biology were omitted.

- 2. Comments from the previous assessment:** *“To increase success rate in the ERA. (participation in COSTs has not resulted in any participation in large European collaborative project; relatively low ratio between external resources and salary budget 0.3; rather low efficiency in obtaining the funding from APVV)”*.

There are not remarkable differences in an absolute number of projects acquired by Institute compared to previous assessment period. However, considering shorter monitored assessment period, there is an improvement.

In COST programmes, the Institute was involved in 10 COST Actions in 2012-2015 comparing to 7 COST Actions in 2007-2011. While in the previous assessment period the Institute was involved in one Norway Grant and one FP7 re-integration grant, in the present assessment period the Institute obtained another FP7 grant (Call: FP7-PEOPLE-2013-IRSES, Contract number 612587) which can be regarded as international recognition of the Institute on the international scene.

Regarding APVV projects, several proposals have been submitted for evaluation, but finally only 2 have been granted during present evaluation period.

As to projects supported by EU SF, the Institute was successfully involved into 2 large projects during monitored evaluation period allowing to carry out reconstruction of several laboratories and to equip the laboratories with advanced infrastructure.

The Institute has extensive international cooperation represented by high number of bilateral projects – altogether 12 projects during present evaluation period was granted (APVV or MAD/bilateral academic agreements).

Finally, it has to be emphasized that the number of scientific staff of the Institute decreased from 23 researchers in 2012 to 19 at the end of 2015.

- 3. Comments from the previous assessment:** *“To clarify unambiguously association of the Institute with the long-distance scientists (prof. Jozef Šamaj). Papers with no institute address; the results have been done at foreign institution under support of foreign institute where an employee from IPGB spent some time. Moreover, 21 papers have been published by a single scientist (mainly prof. Jozef Šamaj), who has several affiliations including IPGB but the principal address was in Germany; valuable proportion of high quality outputs have not been experimentally done at the institute and the institute has one scientist (Šamaj J) who is not present at the institute but institute uses his high quality papers; also citations are biased by the those of Šamaj J.”*

Director of the Institute has made extensive effort to communicate with prof. Jozef Šamaj, but was unable officially terminate his employment contract, yet. Recently, the employment lawyers negotiate the employment relationship with prof. Šamaj.

Regarding the publications and citations, no scientific outputs of prof. Šamaj are used in the present evaluation material. Only results which have been achieved in cooperation of prof. Šamaj with researcher from IPGB or research supported by the IPGB are mentioned. All published papers/citations of former colleague prof. Šamaj listed in accreditation material have affiliation of IPGB SAS.

- 4. Comments from the previous assessment:** *“To improve research outputs and responses based on the research work performed at the institute.”*

Comparing to previous assessment an evident improvement in the research outputs at the Institute during present period was achieved. Thanks to significantly improved research infrastructure at the Institute and higher efficiency of granted projects also more institute's staff could perform their research activities in Slovakia. The publication activity was oriented mostly towards higher quality journals. While during previous evaluation period the average number of papers published in WOS and SCOPUS journals was 14.2 papers/1year, in the present evaluation period it was 16.75 papers/1year.

Similar situation appears also in responses to the research outputs – during the previous assessment period the mean number of WOS citations/1year reached 332 while during monitored period this number increased to 437 citations per year. All papers used in questionnaire were performed and supported by the Institute or during short-term research stays carried out in framework of joint projects with foreign partners.

- 5. Comments from the previous assessment:** *“To create a wider space for young or middle-aged gifted and most successful scientists. The problem of personal management is evident, especially in getting the DrSc. degree; none of scientists with DSc degree is below 60 which would affect the possibilities of PhD studies. The number of PhD students is rather low for the number of potential supervisors, and also relatively high number of the students quitted; In the area of PhD studies there is some progress but still several students quitted the studies and even worse problem is the future accreditation as are there is none of scientists with DrSc degree below 60 who can guarantee the PhD program.”*

During evaluated period all of PhD students successfully completed their doctorate study. However, there is a decline in the number of students who would like to pursue PhD. that seems to be a trend in all academical sphere, not only in SAS research bodies. For example, in 2015 the Institute announced three new PhD topics, but only one candidate was interested to study. There is an evident lack of personal motivation.

On the other hand, critical for PhD holders is a future job/career prospects - either permanent position (full time job) or at least a contract position. An intentional effort must be generally made to resolve financial constraints and lack of job prospects for PhD's.

However, the positive feature for the future is that two of IPGB senior researchers during monitored assessment defended their doctoral thesis and have been gained the scientific degree "Doctor of Science" (Dr.Sc.). Recently, the IPGB has three scientists with such degree that enables to guarantee the three different PhD study programmes for next five years.

**6. Comments from the previous assessment:** *"Institute should be involved in compiling credible information about food safety in context with ever increasing application of molecular biology in food industry, namely manipulations of plants and animals by genetic engineering. It should educate general public to minimize fear and resentment the public feels towards these new technologies (there are still some problems with a transfer of knowledge to practice)."*

As the only scientific body in the frame of SAS performing research on plant GMO using genetic engineering we are aware of responsibility to educate general public to minimize public fear and resentment towards new GMO technologies. Therefore, the Institute increased its activities in the field of compiling credible information about food safety in context of genetically modified crop utilisation. Several lectures and published papers on GMO issue were presented at different occasions (see below). Moreover, research orientation on GMO-friendly technologies, e.g. excision of marker/antibiotic selection genes from the GMO plant during their growth is one of the approaches how to obtain so called "bio-safe GM plants". The preparation of such plants also contributes to the acceptance of GM plants by general public.

As regard to food safety issue, research on amaranth mutation breeding gained the public attention. The collection of mutants was obtained through former cooperation with International Atomic Energy Agency (IAEA, Vienna, Austria) and new amaranth variety was released in Slovakia in 2013. The information about ongoing research on mutagenesis and mutation breeding as well as on current testing of the mutant lines as potential new varieties were presented during international agriculture exposition Agrokomplex and some scientific events.

In the field of small fruit micropropagation, the transfer of knowledge to practice is made by close cooperation with company Wellberry focused on testing the vitality and adaptability of *in vitro* obtained plants under field conditions. During two EU SF projects "Utilization of innovative scientific approaches for effectivity increasing in forest management" and "Biotechnologies as a tool of advanced agriculture for overcoming of anticipated climatic changes (drought, increasing temperature)" the transfer of knowledge into practice was implemented through several education seminars and the project web pages ([www.efles.sk](http://www.efles.sk) and [www.biopole.sk](http://www.biopole.sk), active till end of 2015). These web pages have served to provide the public with publications/monographs and discussion forum on the project topics. The hard copies of published monographs were widely distributed to the persons interested in the project's topics and to the relevant institutions e.g., the Slovak Agriculture and Food Chamber, the Slovak Forestry Company and to the Agricultural Paying Agency.

**List of activities directed towards general public:**

**Presentations**

[1] Title: **Transgenic trees: advantages and disadvantages**

Author: Jana Moravčíková

Event: Science Café

Date: March 29, 2012

Place: Zvolen

[2] Title: **Genetically modified plants: their advantages and disadvantages**

Author: Jana Moravčíková

Event: Visit of MONSANTO INNOVATION CENTRE Borovce

Date: October 10, 2013

Place: Borovce

[3] Title: **Biotechnologies for improved plants and more quality food**

Author: Andrea Hricová

Event: excursion of secondary school scholars

Date: June 18, 2014

Place: Nitra

[4] Title: **New variety of amaranth 'Pribina'**

Author: Andrea Hricová

Event: International agricultural exhibition Agrokomplex 2014 (presentation during a competition, award "Gold Sickle" achieved in the section Plant Production)

Date: August 20 - 23, 2015

Place: Nitra

[5] Title: **Good appetite in the future**

Authors: Jana Moravčíková, Martin Hajduch

Event: European Researchers' Night

Date: September 25, 2015

Place: Bratislava

### **Articles**

[1] Title: **GM food is a threat wrongfully**

Author: Andrea Hricová

Date: November 23, 2012

Place: on-line newspaper webnoviny.sk

<http://www.webnoviny.sk/rozhovory/geneticky-modifikovane-potraviny-su-st/582053-clanok.html>

[2] Title: **We need to feed people... also thanks to GMO**

Author: Jana Libantová

Date: June 26, 2013

Place: online newspaper SME

<http://tech.sme.sk/lc/6820854/potrebujeme-nakrmit-ludi-aj-vdaka-gmo.html>

[3] Title: **Genetically Modified Food**

Author: Jana Libantová

Date: March 18, 2015

Place: online RTVS

<http://slovensko.rtvs.sk/clanky/spolocnost/76256/geneticky-modifikovane-potraviny>

### **Posters**

[1] Title: **Modern methods of vegetative propagation of conifers**

Author: Božena Vooková

Event: International agricultural exhibition "Agrokomplex 2012"

Date: August 23 - 25, 2012

Place: Nitra

[2] Title: **Two dimensional electrophoresis as an important tool to study wheat proteins**

Authors: Soňa Fekečsová, Ľubica Uváčková, Katarína Klubicová, Martin Hajduch

Event: International agricultural exhibition "Agrokomplex 2013"

Date: August 22 - 24, 2013

Place: Nitra

[3] Title: **Use of advanced biotechnologies in amaranth breeding programme**

Authors: Andrea Hricová, Alena Gajdošová, Gabriela Libiaková

Event: International agricultural exhibition "Agrokomplex 2014"

Date: August 21 - 24, 2014

Place: Nitra

[4] Title: **New variety of amaranth ‘Pribina‘**

Authors: Andrea Hricová, Alena Gajdošová, Gabriela Libiaková, Jozef Fejér

Event: International agricultural exhibition “Agrokomplex 2015”

Date: August 20 - 23, 2015

Place: Nitra

[5] Title: **Broomrapes - unusual weeds**

Author: Radoslava Matúšová

Event: International agricultural exhibition “Agrokomplex 2015”

Date: August 20 - 23, 2015

Place: Nitra

- **Supplementary information and/or comments on management, research infrastructure, and trends in personnel development**

The structure of recent IPGB’s management is the same as during previous assessment, e. g. it consists of four persons: director, two vice-directors and scientific secretary.

Thanks to successful participation in EU SF project “AgroBioTech” (cca 1 million EUR) obtained in 2014-2015 the IPGB succeeded in significant improvement of research infrastructure – altogether three new laboratories and four culture chambers/rooms were established and numerous new and more sophisticated laboratory equipments were obtained.

In 2011-2014 the IPGB took part in another EU SF project (No. 26220220097) financed by amount 268 128 EUR, that was also used to improve and upgrade laboratory infrastructure.

The end of monitored assessment period was positive also from the point of personal development. Two of IPGB senior researchers (Martin Hajduch, Terézia Salaj) defended their doctoral thesis and have been gained the highest scientific degree according to SAS rules – Doctor of Science (Dr.Sc). Currently, the IPGB has three scientists with such degree what enables us to guarantee the three different PhD study programmes.

Moreover, one of employees (Katarína Klubicová) has gained the scientific level “senior researcher” in 2015, what means she is eligible to be a supervisor for PhD students in the future.

Many of the researchers take part also in teaching activities by giving lectures and practical courses for graduate and PhD students at Comenius University in Bratislava, Slovak University of Agriculture and the Constantine the Philosopher University in Nitra. As regards to teaching activities at universities, two employees (Jana Moravčíková, 51 years and Jana Libantová, 49 years) have applied for the position of “Associated professor” at the Faculty of Biotechnology and Food Science, Slovak University of Agriculture. Currently, this issue is under consideration of Scientific Board of the Faculty.

Despite the fact that every year in average 2-3 PhD students finish their studies at the Institute, we still have to face very serious personnel problem – ageing of scientific staff. However, because of limited salary budget, we are not able to include at least the best of them among the permanent staff. So - mostly based on personal contacts - we try at least to support PhD holders to get fellowships abroad.

### **3. Research strategy and future development of the institute for the next five years (2016-2020)** (Recommended 3 pages, max. 5 pages)

#### **3.1. Present state of the art in both the national and the international contexts**

Currently, the scientific activity of the Institute is concentrated in three research departments in which work 16 researchers and 6 PhD students. During the assessment period these working groups have been involved altogether in 16 projects granted by Slovak Grant Agencies (13 VEGA, 3 APVV), 11 international bilateral projects, 10 COST projects, 2 projects supported under the scheme of 7FP and 4 projects financed by SF EU. Majority of above project's topics was focused on examination of growth and development of plants under stress conditions, factors influencing gene expression and regulation of plant regeneration and development under *in situ* and *in vitro* conditions.

**Department of Molecular Biology and Biotechnology (DMBB)** has preferably been involved in two main research topics: (1) Identification and isolation of genes involved in the biotic and abiotic stress; and the impact analysis when they are overexpressed in the transgenic organism (2) modulation of the transgene expression in plants with the goal to make them safer for the environment and more acceptable to the consumers.

The effects of abiotic stresses (drought, heavy metal pollution) have been studied mostly in cooperation with the Research Institute of Plant Production (Piešťany, SR). This comprised the screenings for abiotic stress tolerance of selected crops (wheat, maize, etc.) which are of breeding interest at PCRC. These experiences have been also used in mutual project with the Polish colleagues from the Institute of Plant Physiology PAN (Krakow).

Within the biotic stress, the attention was paid to the isolation and characterisation of genes for hydrolytic enzymes glucanases and chitinases, that are expected to support defence machinery against pathogens following their introduction into the target organism. For this purpose the sundew (*Drosera rotundifolia*) serves as a source of genes in these long-term studies.

Parasitic plants represent a specific type of biotic stress for plants. Several *Striga* (witchweed), *Phelipanche* and *Orobanchae* spp. (broomrapes) belong to the group of economically important parasitic weeds of the Orobanchaceae family with negative impact on crop production. Therefore, our effort was focused on the molecular basis of the interaction between the host plant and the parasite and on key signalling molecules involved in their interactions. This research activity was performed in close cooperation with Dutch colleagues (UR, Wageningen).

Currently, the transgenic plants have a lot of supporters as well as opponents. One of the arguments of the opponents is the question of their risk assessment for humans and the environment. We focused on the preparation of the transgenic plants, the progeny of which contains only the desired gene. For this the Cre/loxP system was used, while the selectable marker gene encoding resistance to the antibiotics was successfully spliced in the pollen and the embryo of primary transformants.

The research activities carried out at the **Department of Reproduction and Developmental Biology (DRDB)** are also directed preferably towards the study of heavy metal stress, however, especially using the plants grown in radioactive Chernobyl area. These problems are solved by proteomic approach, the main research tool of this group.

However, the determination of allergenic proteins in cereals and protein composition in plant embryos are of research interest of this group, too. All these research activities are carried out (besides cooperation with Institute of Virology, SAS and Slovak University of Agriculture, Nitra) in multinational cooperation (Ukraine, Germany, U. K., USA, Taiwan, Japan, Czech Republic, etc.).

At the **Department of Population Genetics and Breeding (DPGB)** the research activities are focused towards artificial hybridization of coniferous species (*Abies*, *Pinus*) with the aim to get new hybrids with the desired properties. The study of genetic relationships among these species is included as well (cooperation with Faculty of Forestry, Zvolen, SK). Hand in hand with above research the multiplication of obtained rare hybrids

by somatic embryogenesis approach and their long-term storage by cryopreservation (close cooperation with Catholic University Leuven, Belgium) are carried out, too.

In the field of *in vitro* propagation, the attention has been paid to the elaboration of effective protocols for *in vitro* multiplication of less known small fruit species and their testing in field conditions (in cooperation with private company Wellbery).

Recently, at the DPGB in the frame of long-term breeding program, we succeeded in selecting new lines of *Amaranth* spp. (based on originally obtained lines after  $\gamma$ -irradiation at IAEA, Vienna) with better production and nutrition properties. The major output of this breeding effort at the Institute for the practice was the registration of the first new variety of amaranth in Slovakia and granting the Breeder's Certificate on *Amaranthus cruentus*, cultivar 'Pribina' (with co-author from Prešov University in Prešov, SK).

In conclusion, a broad scale of approaches are used in current research activities at IPGB involving molecular biology, genetic engineering, *in vitro* techniques and different –omics technologies. The knowledge obtained so far has been implemented in introduction of new genetic and biotechnological processes in agricultural plant production improvement. In case of forest trees, an increase of their tolerance towards environmental stresses and better growth performance was achieved by producing new hybrids.

### **3.2. Research strategy of the institute in the national and the international contexts, objectives and methods**

Thanks to cooperation with the two universities in Nitra - the Slovak University of Agriculture in Nitra and the Constantine the Philosopher University in Nitra - resulting in successful completion of the EU Structural Funds project (ITMS 26220220180) "Creation of the Research Centre AgroBioTech" in 2015, the research infrastructure at the institute was improved significantly. With this modernization is the expectation that in the future we will be able to get better results in both basic and applied research.

Based on current organizational structure, intention is to continue in ongoing research activities in the future with three existing departments. However, in case the number of scientific staff will be changed, the organization structure of the institute will be changed as well.

Another very important moment for the future development of the institute can be an effort of Presidium of SAS (and in accordance with government regulation) to encourage research institutes for merging into larger units. In this context, the Institute is also looking for opportunities to join an appropriate larger unit. Starting in 2014, first negotiations with potential partner research bodies have been done. The most eligible partners for the Institute has been considered the Institute of Botany, the Institute of Landscape Ecology and the Institute of Forest Ecology. Merging into one large research body will give to all partners much higher scientific potential with a better chance to apply for the projects like H2020. However, until this process is completed the research focus for the future is as follows:

The working group at the **DMBB** will be focused on the isolation and characterization of new genes with potential application in plant biotechnology in order to improve plant resistance against biotic stress (fungi, parasitic plants) using subtracted libraries and quantitative RT-PCR. We have found there are interactions between the defence and carnivory mechanisms. Based on previous research with Pathogenesis-related proteins isolated from the carnivorous plant sundew (*Drosera rotundifolia*) also other carnivorous plants will be included in the research. We suppose the hydrolytic enzymes (chitinases, glucanases) involved in the digestive processes of this specific group of plants have the potential for the use in plant biotechnology. After the transfer of specific genes into plants, the level of their resistance to plant pathogens will be tested both under *in vitro* and *in vivo* conditions. However, for successful plant transgenesis the promoters with specific sequences – insulators – play a very important role. Because the number and functionality of suitable insulator sequences is being limited in plant

biotechnology so far, identification and isolation of such insulator sequences protecting the transgenic expression unit from the influence of neighbouring DNA sequences, will be the goal in the future.

In the field of abiotic stress the effort will be focused on study of defence mechanisms in plants exposed to different types of abiotic stress in both intact and *in vitro* transgenic plants carrying the exogenous dehydrin genes.

The above research activities will be carried out in cooperation with partners from Slovak University of Agriculture in Nitra, University of SS. Cyril and Methodius in Trnava, Institute of Plant Physiology, PAN in Krakow, Institute of Experimental Botany AS CR in Prague and Wageningen University in The Netherlands.

As to biotic stress research, in collaboration with partners from Israel (Weizmann Institute of Science, Rehovot), simple „high- throughput” screening method for testing of large library of chemical substances isolated from plants was developed. This method will enable to test high number of substances for induction of parasitic plant seed germination (*Phelipanche* spp. and *Orobancha* spp.) in a relatively short time. The regulation of parasitic plant seed germination will enable creation of new strategies in the fight with parasitic plants.

The research strategy at the **DRDB** will be focused on the a) advancement of the investigation of plant reproduction in radio-contaminated areas, b) investigation of clinically relevant proteins in seeds and grains, and partially c) research of the reproduction process in trees.

The department is planning to obtain further funding on national and European levels. The techniques of quantitative gel-based and gel-free proteomics (including protein posttranslational modifications) and genomic techniques (such as gene cloning, the analyses of gene methylations, or AFLP mapping) will be used. To implement this research strategy, instrumentation for isoelectric focussing, various types of electrophoresis, tandem mass spectrometry (MS/MS), liquid chromatography, gene sequencers, PCR machines, etc. will be used. This will be complemented by the state-of-the-art bioinformatics platform which enables quantitative analyses of protein/DNA, MS/MS data, and processing of extensive protein/DNA databases.

These activities will be performed on national level, preferably with the Institute of Virology and Institute of Chemistry SAS as well as with Slovak universities. At the international level the cooperating partner bodies will be, in particular, the Institute of Cell Biology & Genetic Engineering of NAS of Ukraine, National Institute of Crop Science (Japan), University of Missouri – Columbia (USA), National Chung Hsing University (Taiwan) and some other partners from U.K., Germany, Belarus and Czech Republic.

The research at **DPGB** will be focused on genetics, breeding and *in vitro* propagation aspects in selected woody species and crop plants. In the field of forest tree genetics the attention will be given to further clarification of the genetic status and fertility of the hybrid swarm populations of Scots pine (*Pinus sylvestris* L.) and mountain dwarf pine (*P. mugo* Turra) in northern Slovakia. Reciprocal crossings of the parental species will be done to confirm or deny experimentally the possibility of their spontaneous hybridization in the overlapping zones of the region. The extent of both mutual hybridization of the parental species and introgressive hybridization of the hybrid swarm populations with either *P. sylvestris* or *P. mugo* individuals will be verified using DNA markers. Postulated sterility and/or reduced fecundity of the interspecific hybrids of pines will be studied at pollen and seed levels using *in vitro* germination test. The research aims at the description of the hybrid swarms in molecular and fertility terms as unique endemites in our territory.

As the only laboratory in Slovakia dealing with somatic embryogenesis of woody plants, the Institute will continue in this research approach in progress. In case of *Pinus* sp. to capture a high number of genotypes and among them to select the most „productive” ones will be one of our aims. However, from a scientific point of view to focus our attention to extension of the „initiation window”, i.e. to initiate embryogenic tissue from the explants taken from adult trees (*Abies* spp), will be more important. Biochemical and

molecular events underlying somatic and zygotic embryo development (using proteomic approach for identification as well as quantification of proteins expressed during maturation process) will be in focus of these research objectives.

The hormonal status of developing somatic embryos will be studied in cooperation with Institute of Experimental Botany, Prague and cryopreservation research will continue at Katholik University in Leuven, Belgium.

Preferably *in vitro* approach will be used also for selected less known small fruit species (*Vaccinium*, *Rubus*, *Lonicera*, *Amelanchier* spp.). Breeding and propagation will include development of efficient adventitious regeneration system as an essential tool for application of genetic engineering. Optimization of systems for micropropagation, development of protocol for long-term storage of small fruit genetic resources by cryopreservation and testing of genetic fidelity of *in vitro*-derived plants using molecular markers will be done. This will enable to evaluate suitability of elaborated protocols for their application for long-term storage of genetic resources and finally, routine large-scale propagation of healthy and true-to-type planting material available for practical use.

These objectives will be carried out within a close collaboration with researchers of Fruit Research Institute, Čačak (Serbia) and with Research and Breeding Institute of Pomology Holovousy, Czech Republic, where long-term intensive collaboration already exists.

The objectives of amaranth research, a very promising topic for the future, will primarily focus on identification of advanced mutant lines for food and feed purposes. Thus, the scope of future study will be to examine the content of selected nutrients, bioactive substances and interesting metabolites in the edible parts of amaranth plants using the most recent approaches of bio- and -omics technologies (genomics and reverse genetics tools and proteomics).

Evaluation and selection of amaranth mutant lines, as potential new varieties, will be carried out in cooperation with the Prešov University in Prešov and the Slovak University of Agriculture in Nitra. The facilities of the AgroBioTech, as the regional competent centre of applied research and development in the field of agro-bio-technologies, will be extensively used. Long-term cooperation developed with the Gen Bank in Slovakia and the Gen Bank in the Czech Republic will continue. We plan to intensify informal cooperation with University of Helsinki (Finland) and to establish partnership with 3 laboratories of the Visegrad Group countries (The Jagiellonian University, Krakow; Crop Research Institute, Prague; Budapest University of Technology and Economics, Budapest) through The International Visegrad Fund.

Since the IPGB has recently been accredited for the two PhD programmes - Genetics (in cooperation with the Faculty of Science, Comenius University, Bratislava) and Agrobiotechnology (in cooperation with Slovak University of Agriculture in Nitra) the training and education of PhD students will also be our concern.

<b>Project proposals submitted to 7RP or H2020</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
<b>Institute as coordinator</b>	0	0	0	0
<b>Institute as participant</b>	0	0	0	2

#### **4. Other information relevant for the assessment**

The Institute of Plant Genetics and Biotechnology in Nitra in the SAS structure belongs to the institutions in the group of Agricultural and Veterinary Sciences. Its role in the frame of biological-ecological sciences is devoted to study of genetic aspects of growth and development of plants as well as to breeding and propagation of crop species using molecular biology and biotechnology approaches.

Despite limited number of researchers (22 scientists and 11 PhD students in 2012, 16 scientists and 6 PhD students in 2015) we are still able to keep expected standards in research and education. Thanks to individual effort of each research and supporting staff we are able to keep our position and reputation on both home and international level. In some areas of research the obtained results (for instance the results of proteomics experiments in radio-contaminated area after Chernobyl disaster or the somatic embryogenesis of coniferous species) are well known even outside of Europe.

Based on these outputs and personal contacts of our researchers with partners abroad as well as on mutual projects, the IPGB is attractive for many foreign workers, in particular young scientists and PhD students. During the assessment period we have taken 53 scientists from Europe, Africa, Asia and USA who spent at the institute altogether 1 046 days. Especially the cooperation with SAIA is very beneficial in providing the support in particular to scientists from Eastern Europe.

The positive fact is that through participation in EU SF we were able to gain significant improvement of research infrastructure at the institute. On the other hand we have still to fight with the limited financial resources either for salary or research budget. As a consequence, a few perspective research workers have decided to leave the institute or change the profession.

Anyway, to keep the positive way in institute's personnel policy also in the future is the permanent task for the management of the IPGB.