

## CHARACTERISTICS OF THE PLANT ASCORBATE PEROXIDASE FAMILY

GRAŻYNA DĄBROWSKA<sup>1\*</sup>, ALEKSANDRA KATA<sup>1</sup>, ANNA GOC<sup>1</sup>, MAGDALENA SZECHYŃSKA-HEBDA<sup>2</sup>, AND EDYTA SKRZYPEK<sup>2</sup>

<sup>1</sup>*Department of Genetics, Nicolaus Copernicus University,  
ul. Gagarina, 987-100 Toruń, Poland*

<sup>2</sup>*Polish Academy of Sciences, F. Górski Institute of Plant Physiology,  
ul. Niezapominajek 21, 30-239 Cracow, Poland*

\*e-mail: browsk@uni.torun.pl

Received November 5, 2006; revision accepted April 21, 2007

This paper reviews plant ascorbate peroxidases (APX), an important part of the antioxidative system, maintaining the balance and uninterrupted functioning of the plant cell. The main role of APXs is to control the hydrogen peroxide concentration in cells. In reaction the enzymes use ascorbate as an electron donor. The active site is highly conserved by every member of the APX family. APXs belong to class I of the superfamily of bacterial, fungal and plant peroxidases. All the isoforms differ from each other in molecular weight, optimal pH, stability, substrate specificity, localization and level of response to specific stress conditions. It is suggested, however, that the responsible genes originated from one common gene by multiple duplication events followed by natural selection.

**Key words:** Ascorbate peroxidase, gene evolution, oxidative stress, hydrogen peroxide, antioxidative system, ROS, photosynthetic electron transport, programmed cell death (PCD), nitric oxide, gene expression.

# ANATOMY OF LEBANON CEDAR (*CEDRUS LIBANI* A. RICH.) WOOD WITH INDENTED GROWTH RINGS

BARBAROS YAMAN\*

*Zonguldak Karaelmas University, Faculty of Forestry, Bartin, 74100, Turkey*

\*e-mail: [yamanbar2000@yahoo.com](mailto:yamanbar2000@yahoo.com)

Received June 30, 2006; revision accepted January 30, 2007

This study examined the anatomical characteristics of indented growth rings in Lebanon cedar. In the indented pattern of growth rings, the alignment and shape of tracheids and rays were found to be irregular, and distinctive trabeculae were identified in tracheids. Multiseriate parenchymatic rays occur in addition to uniseriate and biseriate ones. In the indented pattern the average tracheid length is shorter, whereas the lumen diameter and double-wall thickness are wider than those of unindented ones. The average maximum ray height is greater than that of normal wood. The average number of tracheids per mm<sup>2</sup> differs only in latewood.

**Key words:** *Cedrus libani*, indented rings, tracheids, traumatic tissue.

**MICROPROPAGATION OF SIX *PRUNUS MUME* CULTIVARS THROUGH AXILLARY SHOOT PROLIFERATION, AND ISSR ANALYSIS OF CLONED PLANTS**

GUOGUI NING, XIAO LI FAN, WEN JUN HUANG, MAN ZHU BAO\*, AND JIN BO ZHANG

*Key Laboratory of Horticultural Plant Biology, Ministry of Education,  
College of Horticulture and Forestry Sciences, Huazhong Agricultural University,  
Wuhan 430070, P.R. China*

\*e-mail: [mzbao@mail.hzau.edu.cn](mailto:mzbao@mail.hzau.edu.cn)

Received November 2006; revision accepted March 7, 2007

*Prunus mume* is one of the most popular landscape plants in China and Japan. A successful in vitro propagation system for six cultivars of *Prunus mume* has been developed by in vitro culture of nodal segments from seedling and mature plants. High multiplication rates (from 2.5 to 5.5) were achieved using modified MS media and WPM basic media supplemented with TDZ, BA, IBA, 2,4-D or NAA at concentrations adjusted for each cultivar. All the studied cultivars could be proliferated efficiently on WPM media supplemented with 2.2  $\mu$ M TDZ, 2.2  $\mu$ M BA and 2.5  $\mu$ M IBA. Shoots were rooted on agar-gelled 1/2 MS or WPM basic media containing 2.5 or 5.0  $\mu$ M IBA, and plantlets were transferred to pots after they had grown more than 3 roots and at least one root was more than 10 mm long. The effects of TDZ, media composition and different genotypes on shoot multiplication and growth were studied in detail. The genetic fidelity of the micropropagated plants from the 'Xuemei' cultivar was examined using PCR-ISSR markers, and the results demonstrated complete genetic stability in the cloned plants.

**Key words:** *Prunus mume*, micropropagation, genetic stability, ISSR markers, tissue culture.

**ENDOREDUPPLICATION IN THE SUSPENSOR OF *GAGEA LUTEA* (L.) KER GAWL. (LILIACEAE)**

MAŁGORZATA KOZIERADZKA-KISZKURNO\*, JOANNA ŚWIERCZYŃSKA,  
AND JERZY BOHDANOWICZ

*Department of Genetics and Cytology, University of Gdańsk,  
ul. Kładki 24, 80–822 Gdańsk, Poland*

\*e-mail: [stokrota@biotech.ug.gda.pl](mailto:stokrota@biotech.ug.gda.pl)

Received February 15, 2007; revision accepted May 10, 2007

Karyological processes of differentiation of the suspensor of *Gagea lutea* (L.) Ker Gawl. were compared with the development of the embryo proper. The zygote divides into the smaller apical cell and the bigger basal cell, which becomes the basal cell of the suspensor. The mature suspensor consists of a huge basal cell and a few chalazal cells. The nuclear DNA content of the suspensor basal cell attains a high degree of ploidy, up to 128C. Nuclei with the highest ploidy level of 128C were found only in fully differentiated basal cells of more than 20-celled embryos. During polyploidization, the volume of the nuclei increased, and changes in the chromatin structure of polyploid nuclei were noted. With increasing levels of ploidy, polytene chromosomes were observed in the suspensor nucleus. Changes in DNA content, nucleus size and chromatin structure point to endoreduplication as the mechanism of polyploidization of the suspensor in *Gagea lutea*.

**Key words:** *Gagea lutea*, DNA cytophotometry, endoreduplication, polytene chromosomes, suspensor, basal cell.

**GENOME SIZE VARIATION OF *LOTUS PEREGRINUS* AT  
EVOLUTION CANYON I MICROSITE, LOWER NAHAL OREN, MT. CARMEL, ISRAEL**

NIKOL GASMANOVÁ<sup>1</sup>, ALEŠ LEBEDA<sup>1\*</sup>, IVANA DOLEŽALOVÁ<sup>1</sup>,  
TOVA COHEN<sup>2</sup>, TOMÁŠ PAVLÍČEK<sup>2</sup>, TZION FAHIMA<sup>2</sup>, EVIATAR NEVO<sup>2</sup>

<sup>1</sup>*Department of Botany Palacký University in Olomouc, Šlechtitelů 11,  
783 71 Olomouc-Holice, Czech Republic*

<sup>2</sup>*Institute of Evolution, University of Haifa, Mt. Carmel 31905, Israel*

\*e-mail: ales.lebeda@upol.cz

Received January 10, 2007; revision accepted May 17, 2007

On the basis of previous studies showing a positive correlation between number of copies of retrotransposons and geographical environment, we hypothesized that different ecogeographical conditions on opposite slopes of Evolution Canyon I could cause intraspecific variation in plant genome size. To test this hypothesis, we chose *Lotus peregrinus* L. (annual, self-pollinator) as the first candidate because of its biological contrast to the previously studied carob tree (long-lived, cross-pollinator). Absolute nuclear DNA content of 60 genotypes of *L. peregrinus* was estimated by PI flow cytometry, with tomato (*Lycopersicon esculentum* cv. Stupicke) as internal reference standard. The mean 2C-value in *L. peregrinus* was 2.546 pg, ranging from 2.39 pg to 2.71 pg. The mean 2C-value was higher in plants from the south-facing slope (2.549 pg) than from the north-facing slope (2.544 pg), but we were not able to show significant interslope differences in genome size.

**Key words:** *Lotus peregrinus*, Bird's-foot trefoil, Evolution Canyon, flow cytometry, PI staining, genome size, nuclear DNA content, intraspecific variation, species plasticity.

**POLYPLOID PROGENY FROM CROSSES BETWEEN DIPLOID SEXUALS AND TETRAPLOID  
APOMICTIC POLLEN DONORS IN *TARAXACUM* SECT. *RUDERALIA***

LENKA MÁRTONFIOVÁ<sup>1\*</sup>, ĽUBOŠ MAJESKÝ<sup>2</sup> AND PAVOL MÁRTONFI<sup>2</sup>

<sup>1</sup>*Botanical Garden,* <sup>2</sup>*Department of Botany, Institute of Biology and Ecology,  
P. J. Šafárik University, Mánesova 23, 04352 Košice, Slovakia*

\*e-mail: [lenka.martonfiova@upjs.sk](mailto:lenka.martonfiova@upjs.sk)

Received January 25, 2007; revision accepted May 25, 2007

The paper reports a study of polyploid progeny of crosses between diploid sexual maternal plants and tetraploid pollen donor plants in the genus *Taraxacum* sect. *Ruderalia*. All polyploid progeny plants were triploids; no tetraploids were found. Two types of experiments were done with each plant: crossing of some capitula with diploid pollen donor, and isolation of other capitula. Flow cytometric seed screening, together with analysis of seed set, were used to determine the breeding system of particular hybrids. Of the 29 triploid hybrids studied, 7 plants were apomictic. Seventeen triploid hybrids produced progeny sexually, reduced ovules were fertilized, and seed set was low. Three plants produced (near)tetraploid progeny – B<sub>III</sub> hybrids with autonomous endosperm. The remaining 2 triploid hybrids were nonapomicts, but their type could not be distinguished. Compared with the crosses with triploid pollen donors, the crosses of diploid with tetraploid pollen donors produced fewer apomictic progeny and more nonapomictic progeny with reduced, irregular chromosome numbers. However, the total number of developed seeds per capitulum was substantially higher in diploid × tetraploid crosses, and their impact in microevolutionary processes may be considerable. In both types of crosses, diplosporous plants lacking the capacity for parthenogenesis were produced, confirming the breakdown of apomixis into its elements.

**Key words:** *Taraxacum* sect. *Ruderalia*, *Asteraceae*, breeding system, flow cytometry, hybridization, apomixis, polyploid progeny.

**EFFECT OF *POLYSCIAS FILICIFOLIA* BAILEY EXTRACTS ON THE BEHAVIOR OF THE LEAF MINER *CAMERARIA OHRIDELLA* DESCHKA AND DIMIC ON HORSE CHESTNUT TREES**

Anna Tomczyk<sup>1</sup>, Danuta Kropczyńska<sup>1\*</sup>, Aleksandra Ptak<sup>1</sup>, Marija Titova<sup>2</sup>, Nikolaj Shumilo<sup>3</sup>, Aleksander Oreshnikov<sup>3</sup>, Aleksander Nosov<sup>2</sup>, Mirosława Furmanowa<sup>4\*\*</sup>

<sup>1</sup>Warsaw Agricultural University, Department of Applied Entomology,  
ul. Nowoursynowska 159, 02-787 Warsaw, Poland,

<sup>2</sup>Plant Physiology Department, Biology Faculty, Moscow State University,  
119992 Moscow, Russia

<sup>3</sup>Timiryazev Institute of Plant Physiology, Russian Academy of Science,  
Botanicheskaya St. 35, 127276 Moscow, Russia

<sup>4</sup>Department of Biology and Pharmaceutical Botany, Medical University of Warsaw,  
ul. Banacha 1, 02-097 Warsaw, Poland

\*e-mail: danutakropczynska-linkiewicz@sggw.pl

\*\*e-mail: mfurmanowa@wp.pl

Received December 29, 2006; revision accepted May 28, 2007

Extract of *Polyscias filicifolia* suspension culture was used to reduce damage to horse chestnut (*Aesculus hippocastanum*) leaves by larvae of the horse chestnut leaf miner (*Cameraria ohridella*). The results showed the repellent effect of biomass extracts on *Cameraria ohridella* moths. The number of moths caught per day on sticky traps treated with extract was more than 50% lower than the control. The same extract on leaflets caused *C. ohridella* females to lay ~20% fewer eggs than on leaflets without extract. *P. filicifolia* extract had a repellent effect on female moths in laboratory conditions as well. Only single mines were observed on leaves treated with *P. filicifolia* extract, five times less than on control leaves. The data indicate that *P. filicifolia* extract can be used as a repellent for *C. ohridella* in springtime when the overwintering generation emerges from pupae.

**Key words:** *Polyscias filicifolia*, suspension culture, *Aesculus hippocastanum*, *Cameraria ohridella*.

**POLLEN VIABILITY IN HYBRID SWARM POPULATIONS OF *PINUS MUGO* TURRA  
AND *P. SYLVESTRIS* L.**

ANDREJ KORMUTAK<sup>1\*</sup>, JANA BOHOVIČOVA<sup>1</sup>, BOŽENA VOOKOVA<sup>1</sup> AND DUŠAN GÖMÖRY<sup>2\*\*</sup>

<sup>1</sup>*Institute of Plant Genetics and Biotechnology, Slovak Academy of Sciences, Akademicka 2,  
P.O.Box 39A, SK-950 07 Nitra, Slovakia*

<sup>2</sup>*Technical University in Zvolen, T.G. Masaryka 24, SK-960 53 Zvolen, Slovakia*

e-mail: \*nrgrkorm@savba.sk

\*\*gomory@vsld.tuzvo.sk

Received January 30, 2007; revision accepted June 1, 2007

Pollen viability was tested in two hybrid swarm populations of *Pinus mugo* and *P. sylvestris* in northern Slovakia and in control populations of the parental species. It was significantly reduced in hybrid populations, as evidenced by average germination percentages ranging from 49.0% and 61.53% and by pollen tube length averaging 74.54–86.47  $\mu\text{m}$ . The corresponding values in the control populations were 78.38–88.5% and 102.92–152.84  $\mu\text{m}$ , respectively. The frequency of microsporogenesis disturbances at the tetrad and mature pollen stages was higher in hybrid swarms than in the control population of *P. sylvestris*. Based on in vitro germination data, the amount of sterile pollen was estimated at 40–41% in hybrid swarm populations, 12% in *P. sylvestris*, and 21% in *P. mugo*.

**Key words:** *Pinus sylvestris* L., *P. mugo* Turra, hybrid populations, pollen viability.



## LEAF ANATOMY AND HAIRS OF TURKISH *SATUREJA* L. (LAMIACEAE)

FATİH SATIL<sup>1\*</sup> AND AYL A KAYA<sup>2</sup>

<sup>1\*</sup>*Department of Biology, Balýkesir University, 10145 Balýkesir, Turkey*

<sup>2</sup>*Department of Pharmaceutical Botany, Anadolu University, 26470 Eskisehir, Turkey*

Received January 25, 2007; revision accepted June 15, 2007

There are some taxonomic uncertainties within the Turkish members of *Satureja*. It is extremely difficult to distinguish some *Satureja* species because of their great morphological similarity. *Satureja* species are used as herbal teas and spices, and for this reason they are important commercial and medicinal plants. In this study, the leaf anatomy and hair features of species were examined by LM and SEM. The investigated species can be divided into two main groups, as bifacial and equifacial leaves according to mesophyll structure. They can be secondarily divided into two types based on the midrib region in cross section, as projecting or nonprojecting. Thirdly, two main vascular bundle types can be identified in transverse section according to the presence or absence of sclerenchyma. All species have glandular, peltate and capitate, and nonglandular hairs and diacytic stomata, but the covering hairs differ between species. The leaves of fifteen *Satureja* L. species were studied in order to assess anatomical variations that may serve as distinguishing characters, and to evaluate their significance for the taxonomy of the genus.

**Key words:** Lamiaceae, *Satureja*, leaf anatomy, glandular hairs, nonglandular hairs, Turkey.

## RFLP ANALYSIS OF MITOCHONDRIAL DNA IN THE GENUS *SECALE*

LIDIA SKUZA<sup>1\*</sup>, STANISŁAWA M. ROGALSKA<sup>1</sup>, JAN BOCIANOWSKI<sup>2</sup>

<sup>1</sup> Chair of Cell Biology, University of Szczecin, ul. Wąska 13, 71-415 Szczecin, Poland,

<sup>2</sup> Department of Mathematical and Statistical Methods, Agricultural University of Poznań,  
ul. Wojska Polskiego 28, 60-637 Poznań, Poland

\*e-mail: skuza@univ.szczecin.pl

Received December 23, 2006; revision accepted June 15, 2007

RFLP analysis of mitochondrial DNA was carried out with eight restriction enzymes *Bam*HI, *Eco*RI, *Hae*III, *Hind*III, *Msp*I, *Pst*I, *Sal*I and *Xho*I, from which nine mitochondrial gene probes (*atp6*, *atp9*, *atp1*, *cox1*, *nad3*, *nad6*, *nad9*, *pol-r*, *orf25*) were hybridized, by means of digestion products, for seven species of the genus *Secale*. RFLP *Eco*RI/*pol-r* specific markers were determined for all the species of rye. To estimate the relationships among species, genetic pairwise similarities between them were estimated and a UPGMA dendrogram was constructed. The analysis separated the species into two groups. The first comprises the pair *Secale sylvestre* Host and *S. cereale* subsp. *segetale* Zhuk., exhibiting the greatest genetic similarity, that is, closest relationships. The second group is composed of *S. strictum*/Presl/Presl, *S. strictum*/Presl/Presl subsp. *kuprijanovii*/Grossh./Hammer, *S. strictum*/Presl/Presl subsp. *africanum*/Stapf/Hammer, *Secale cereale* L. and *S. vavilovii* Grossh., with one clear subgroup comprising *Secale strictum*/Presl/Presl and *S. strictum*/Presl/Presl subsp. *kuprijanovii*/Grossh./Hammer. The latter two species showed the highest genetic similarity to each other and relatively high genetic similarity to the remaining species in the group.

**Key words:** *Secale*, mitochondrial DNA, RFLP, UPGMA, genetic similarity.

## SYMBIOTIC DRIFT AS A CONSEQUENCE OF DECLINING HOST PLANT POPULATIONS

ANDRZEJ CHLEBICKI\*<sup>1</sup> AND PAWEŁ OLEJNICZAK<sup>2</sup>

<sup>1</sup>*W. Szafer Institute of Botany, Polish Academy of Sciences,  
ul. Lubicz 46, 31-512 Cracow, Poland*

<sup>2</sup>*Institute of Nature Conservation, Polish Academy of Sciences,  
Al. Mickiewicza 33, 32-120 Cracow, Poland*

\*e-mail: [ibchlebick@ib-pan.krakow.pl](mailto:ibchlebick@ib-pan.krakow.pl)

Received January 20, 2007; revision accepted June 20, 2007

In this paper we present a hypothesis about the loss of organisms associated with hosts in small populations. Data for fungi specific to arcto-alpine plants are presented. We found that the number of fungal species on plants is directly proportional to the size of the host population. This conforms to MacArthur and Wilson's theory of island biogeography. Once the host population is below a critical size, some fungal species are lost. We term this process 'symbiotic drift.'

**Key words:** *Dryas*, *Juncus*, habitat island biogeography, fungi.

**EFFECT OF  $\text{Cu}^{2+}$  CONCENTRATION ON GROWTH, ANTIOXIDANT ENZYME ACTIVITY AND MALONDIALDEHYDE CONTENT IN GARLIC (*ALLIUM SATIVUM* L.)**

QINGMIN MENG<sup>1</sup>, JING ZOU<sup>1</sup>, JINHUA ZOU<sup>1</sup>, WUSHENG JIANG<sup>2</sup>, AND DONGHUA LIU<sup>1\*</sup>

<sup>1</sup> *Department of Biology, College of Chemistry and Life Sciences, Tianjin Normal University, Tianjin 300387, P.R. China*

<sup>2</sup> *Library, Tianjin Normal University, Tianjin 300387, P.R. China*

Received February 15, 2007; revision accepted June 30, 2007

The effects of different concentrations ( $10^{-5}$  M,  $10^{-4}$  M,  $10^{-3}$  M) of  $\text{Cu}^{2+}$  on growth, antioxidant enzyme activity and malondialdehyde (MDA) content were investigated in hydroponically grown *Allium sativum* L. The results indicated that the growth of garlic seedlings was not inhibited under treatment with  $10^{-5}$  M  $\text{Cu}^{2+}$ . Garlic seedlings exposed to  $10^{-4}$  M and  $10^{-3}$  M  $\text{Cu}^{2+}$  exhibited significant growth reduction. With increasing  $\text{Cu}^{2+}$  concentration and treatment time, superoxide dismutase (SOD) activity increased in leaves and roots, and peroxidase (POD) activity increased in leaves. In roots of plants exposed to  $10^{-4}$  M and  $10^{-3}$  M  $\text{Cu}^{2+}$ , POD activity increased within 9 d and then dropped, but was still higher than in the control at the end of the experiment. Catalase (CAT) activity increased in seedlings grown at  $10^{-5}$  M and  $10^{-4}$  M, whereas a highly toxic level of  $\text{Cu}^{2+}$  ( $10^{-3}$  M) markedly inhibited CAT activity. SOD and POD activity were higher in roots than in leaves, whereas CAT activity was higher in leaves than in roots under both control and  $\text{Cu}^{2+}$  treatments. There was no obvious effect on MDA content in the seedlings treated with  $10^{-5}$  M  $\text{Cu}^{2+}$ , at  $10^{-4}$  M and  $10^{-3}$  M  $\text{Cu}^{2+}$  it increased. The mechanisms of  $\text{Cu}^{2+}$  toxicity and  $\text{Cu}^{2+}$  tolerance in garlic are briefly discussed.

**Key words:** Copper, *Allium sativum* L., antioxidant enzymes, malondialdehyde.

## SEED INVOLUCRE VARIATION OF *CARPINUS BETULUS* (CORYLACEAE) IN POLAND

BORATYŃSKI ADAM\*<sup>1</sup>, BORATYŃSKA KRYSZYNA<sup>1</sup>, MAZUR MAŁGORZATA<sup>2</sup>,  
AND MARCYSIAK KATARZYNA<sup>2</sup>

<sup>1</sup>*Institute of Dendrology, Polish Academy of Sciences, ul. Parkowa 5, 62-035 Kórnik, Poland*

<sup>2</sup>*Institute of Biology and Environmental Protection, Kazimierz Wielki University,  
Al. Ossolińskich 12, 85-072 Bydgoszcz, Poland*

\* e-mail: borata@man.poznan.pl

Received October 25, 2006; revision accepted July 2, 2007

The paper uses statistical methods to examine whether origination from different Pleistocene centers influences the present-day variation of *Carpinus betulus* in Poland. Twenty-nine populations of the species were sampled in communities of the *Carpinion betuli* alliance in most of the country. Samples of 100 involucre for each population were analyzed for 26 morphological characters. Despite the rather accidental similarities among the sampled populations, their geographic variation confirmed their origin from at least two different refugia, southeast and west.

**Key words:** *Carpinus betulus*, involucre, morphology, plant geography, plant variation, Holocene migration, migration pathways.

## EFFECT OF LIGHT WAVELENGTH ON IN VITRO ORGANOGENESIS OF A *CATTLEYA* HYBRID

TERESA CYBULARZ-URBAN\*<sup>1</sup>, EWA HANUS-FAJERSKA<sup>1</sup>, AND ADAM ŚWIDERSKI<sup>2</sup>

<sup>1</sup>*Department of Botany, <sup>2</sup>Department of Biochemistry,  
Agricultural University, Al. 29 Listopada 54, 31-425 Cracow*

\*e-mail: tcybularz@ogr.ar.krakow.pl;

Received November 20, 2006; revision accepted July 4, 2007

The effect of light wavelength on multiplication, tissue growth and pigment content was studied in *Cattleya intermedia* × *C. aurantiaca* microcutting cultures. The initial explants were shoots regenerated from protocorm-like bodies. Modified MS medium containing 5.0 mg·l<sup>-1</sup> BA, 0.2 mg·l<sup>-1</sup> zeatin and 1.0 mg·l<sup>-1</sup> NAA, solidified with Difco agar, was used for adventitious regeneration of shoots and aerial roots. The rate of organ initiation depended on the wavelength of the monochromatic light applied. Red and blue treatments were effective in triggering photomorphogenesis in the evaluated material. The propagation coefficient reached 11.7 under red light, 10.6 under blue, 8.3 under white and 6.2 in darkness. Total chlorophyll and carotenoid content were highest in cultures illuminated with white light, gradually decreasing from the blue to the red and the far red treatments. Blue light treatment improved the efficiency of micropropagation and benefitted initiation of rhizogenesis and aerial root elongation, and the resulting plants were true to type.

**Key words:** *Cattleya*, monochromatic light, adventitious buds, rhizogenesis, chlorophylls, carotenoids.

**Abbreviations:** BA - 6-benzylaminopurine; NAA - 1-naphthaleneacetic acid; MS - Murashige and Skoog medium; PLBs – protocorm-like bodies.

## DIPLOID CHROMOSOME NUMBERS IN FIVE *HIERACIUM* SPECIES FROM SERBIA AND MONTENEGRO

ZBIGNIEW SZELĄG<sup>1\*</sup>, TOMASZ ILNICKI<sup>2\*\*</sup>, MARJAN NIKETIĆ<sup>3\*\*\*</sup>, AND GORDANA TOMOVIĆ<sup>4</sup>

<sup>1</sup>*Institute of Botany, Polish Academy of Sciences,  
ul. Lubicz 46, 31-512 Cracow, Poland*

<sup>2</sup>*Department of Plant Cytology and Embryology, Jagiellonian University,  
ul. Grodzka 52, 31-044 Cracow, Poland*

<sup>3</sup>*Natural History Museum, Njegoševa 51, 11000 Belgrade, Serbia*

<sup>4</sup>*Institute of Botany and Botanical Garden University of Belgrade,  
Stari grad, 11000 Belgrade, Serbia*

\*e-mail: [azszelag@wp.pl](mailto:azszelag@wp.pl)

\*\*[t.ilnicki@iphils.uj.edu.pl](mailto:t.ilnicki@iphils.uj.edu.pl)

\*\*\* [mniketic@nhmbeo.org.yu](mailto:mniketic@nhmbeo.org.yu)

The genus *Hieracium* L. in Europe is dominated by polyploid, mostly tri- and tetraploid ( $2n = 3x = 27$  and  $2n = 4x = 36$ ), hybridogenous taxa characterized by agamosperous reproduction (gametophytic apomixis) (Skawińska, 1963; Stace, 1989). Sexual diploids ( $2n = 2x = 18$ ) are very rare and restricted mainly to refugial areas of southern Europe such as the Balkans and the Iberian Peninsulas, whose *Hieracium* floras are largely endemic (Merxmüller, 1975). The shares of diploid species reach up to 24% in the Iberian and up to 5% in the Balkan Peninsula (Schuhwerk and Lippert, 1998). Recently, other diploid *Hieracium* (new diploid species or new diploid cytotypes) were found in the Balkans (Vladimirov and Szelağ, 2001a,b; Vladimirov, 2003; Vladimirov and Szelağ, 2006). Knowledge of the ploidy level, which in the genus *Hieracium* indicates the mode of reproduction, is of particular interest in understanding taxonomic and phylogenetic relationships in the genus.