### P0912. A systematic study of the fern genus Polystichum (Dryopteridaceae) in Japan

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Hybridization and polyploidization play the important roles in species diversification and reticulation in the fern genus *Polystichum.* In this study, morphological, cytological and electrophoretic investigations were undertaken in eleven Japanese *Polystichum* species. The polyploidy and genetic patterns of four diploid species and seven tetraploid species were determined. The spore morphology showed the distinct characters in each diploid species, but intermediate among tetraploid species. Electrophoretically, the species-specific marker alleles were detected in four loci of PGM, PGI, SkDH, LAP enzymes in each of four diploid species *P. fibrilloso-paleaceum, P. igaense, P. retroso-paleaceum, P. otomasui.* Electrophoretic variants were detected in the tetraploid species *P. longifrons*, *P. tagawanum* and *P. polyblepharum* (all of them were allopolyploids). Further, six triploid hybrids and five tetraploid hybrids were examined morphologically and erectrophoreticlly, and the putative parents of these hybrids were confirmed. Based on the above, the reticulate evolution of the Japanese *Polistichum* is discussed.

### P0913. Phylogenetic studies in the genus *Doryopteris* J. Sm. (Cheilanthoideae-Pteridaceae)

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*Doryopteris* is the fourth largest genus of Cheilanthoideae-Pteridaceae. A number of species appeared to be congeneric mainly on the basis of soral condition and some of them proved difficult to classify within the genus or in related genera (*Cheilanthes*, *Pellaea* and *Notholaena*). The research was carried out in order to elucidate interspecific relationships within *Doryopteris* and to formulate evolutionary hypothesis of its relationships with the related genera. Data from cpDNA sequences (*trn*L-F and *rbc*L) and morphology were analysed independently and in combination using maximum parsimony. *Doryopteris* is paraphyletic according to the molecular data and polyphyletic with the combined analysis. However, the topologies are congruent with the two sections recognised by Tryon. Cytological data indicate that hybridisation and polyploidy are also playing a role in the evolution of this genus.

### P0914. The study of morphology, sporology and anatomy of the species of the genus: *Athyrium*, along with introducing the new species: *Athyrium distentifolium* in Iran

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The genus *Athyrium* belongs to *Athyriaceae*. Distribution of this genus in Iran is mainly in humid woodlands regions of Caspean Sea coasts in Hyrcanian phytogeographical region and sometimes within rock slots in timberline.
Wendelbo(1976) introduced a species of this genus named *Athyrium filix-femina*.
In current study on the ferns of Northern Iran, the species *Athyrium distentifolia* Tausch ex., is introducing in Iran for the first time.
Noting to morphology, anatomy, sporology - and partly echological - characteristics, could have been differentiated this specis with its neighboring species.
The species *A. distentifolium* contains orbicular sour, without indosium - or soon lost - and spinuluse spores. In transverse sectioning, petiole is siphonostele with six meristele.
The anatomy, sporology and morphology of this genus in Iran are studied and distribution map and determination key for its species are provided.

### P0915. Palinology of twenty five species of the genus *Diplazium* (Woodsiaceae).

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The palinology of *Diplazium* species is studied as a contribution to the knowledge of the genus to ascertain its utility for the delimitation of close species and study the possibility to segregate groups or subgenus of *Diplazium*. Some of the spores were collected in the field, some others were taken from herbarium sheets. The spores were set on a coal tape and this one on a small aluminum stick. Some of the spores were broken to see the spore structure, later on they were covered with coal dust and gold. The micrographs were taken using a Scanning Jeol 35CF microscope. *Diplazium* spores are monolete, 25-75 µm, with a linear aperture 2/3 to ¾ their length. The aperture, however, is often obscured by broad perisporal wings. In most species these wings have irregular margins, but in others are almost entire to fimbriate. Sometimes, the perisporal wings make a wide reticulate, in other times are irregular or make a cristate pattern. The exospore is plain. The perispore usually is of two layers, the lower of which has small papillae, whereas the upper layer is thinner and fragile. The elements between the folds are part of the perispore and they are variable between species.

### P0916. Anatomy of Thirty Species of *Diplazium* (Woodsiaceae)

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The anatomical studies of thirty Neotropical species of *Diplazium* are providing to contribute to the knowledge of the genus and to ascertain its utility for the delimitation of species. Roots of all the species are diarch, with a dictyostelic rhizome, a petiole with three possible xylem strands shapes: hippocampus, elliptical or walking sticks; in the distal petiole or in the rachis the strands are united in a single strand with rounded U or squared U shape. There are mucilage cavities in the xylem parenchyma of the leaf trace. The cortex of the root, rhizome and stipe has starch grains; cells with dense brown content are disposed near or around the meristeles, leaf traces, veins or medulla are present in almost all the species studied. In general the data show that the species present similar anatomy, each one can be differentiated from the others by its shape of the leaf trace, number of caulinar meristeles and distribution of brown content cells. The conclusions confirm the usefulness of anatomical and histochemical characters to delimitate species.

### P0917. To a question on systematization *Ducampopinus krempfii* (Lecomte) *A. chev.* (Pinaceae)

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The structure of bark Ducampopinus krempfii till now remained unexplored. We carried out studying anatomy of young branches of this plant. Investigated by us taxon finds out similarity to Pinus, Keteleeria and Pseudolarix, however on the majority of attributes of a structure of a bark is closer only to first two. Third rather strongly differs on a lot of attributes: the form of cells of epidermis - ellipse; the form of cells of hypodermis; presence in an initial bark sclereids; under the form of cells of phellem in periderm-rectangular or square and some to other attributes. At the same time, at both genus's in a bark is absent resiniferous system and dominate numerous slime idioblastes, quantity crystal parenchyma unsignificantly and is absent typical aerenchyma that specifies doubtless related affinity of these two genus's. Most precise difference Ducampopinus from relatives to it of sorts Pinus and Keteleeria is absence in an initial bark resin ducts and homogeneous phellem of periderm. Results of our anatomic research Ducampopinus represents close, but independent taxon in a rank of independent genus Ducampopinus.

### P0918. Were Mesozoic Ginkgophytes Shrubby?

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Data on leaf morphology in the Mesozoic of North America shows a proportional increase of bifurcated, Ginkgo-like leaves during the middle of the Jurassic. This ginkophyte acme is correlated with a decreased proportion of the leaf forms associated with herbaceous or shrubby pteridophytes, and with no substantial change in the proportion of leaf forms associated with canopy gymnosperms. The increase in Ginkgo-like foliage at the same time as fern-like forms decreased in relative abundance suggests replacement of some part of the forest understory by early ginkgophytes. That is, early ginkgophytes were competing for space in the understory rather than in the canopy. This data suggests that most Mesozoic

ginkgophytes were not canopy trees like the surviving Ginkgo biloba, but shrubs, and may support the argument that has already been made from sedimentological data, that to a much greater extent than do individuals of Ginkgo biloba now cultivated around the world, many ancestral ginkgophytes pursued ruderal or early-successional strategies.

### P0919. Young crown groups in *Gnetum* and *Ephedra* - reconciling molecular age estimates and fossils in Gnetales

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Gnetales comprise *Gnetum* (35 spp.), *Welwitschia* (1 sp.), and *Ephedra* (35+ spp.). An *rcbL* clock gave an age of 32-8 my for the initial divergence among living species of *Ephedra* (Huang & Price 2003), yet fossils with modern reproductive characters existed 110 mya (Rydin et al. 2004; Yang et al. 2005). Using slow-evolving *rbcL* and fast-evolving *matK* for dense species samples, we estimated the ages of the initial divergences in *Ephedra* and *Gnetum*. Both genes, regardless of seed plant topology and clock approach used, yield basal divergences in *Gnetum* of 22-14 my and in *Ephedra* of 16-2 my. The ca. 35 species in each genus appear the result of recent radiations from ancestors that kept certain morphological traits (unknown for *Gnetum*), while congeners went extinct. This seems as plausible as extant species being of Mesozoic age (Rydin et al. 2004). If true, the ages of the *Gnetum* clades (S American (African, Asian)) imply that the genus reached its distribution across water (n.b., some *Gnetum* have buoyant seeds). Recent speciation esp. in Asia would explain the limited morphological divergence, overlapping distribution ranges, and incomplete concerted evolution in rITS.

### P0920. Phylogeny within Cupressus L. with morphological data

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Recent studies on the phylogeny of Cupressus L. are mostly based on molecular data. Even if morphological data are considered then they are often incomplete and sometimes even not correct, because they are based on outdated information. Moreover, none of these trees includes all species of the genus. The understanding of evolution requires careful morphological interpretation of such phylogenetic trees. For the present study, a cladogram was calculated including each Cupressus species (incl. Xanthocyparis FARJON & HIEP) for the first time. This cladogram is based on a matrix of characters resulting from new morphological investigations and critical literature analysis as well. The topology resulting from this study fits well to the spatial patterns of the species. The two species of Xanthocyparis (Xanthocyparis vietnamensis FARJON & HIEP, Xanthocyparis nootkatensis (D. DON) FARJON & HARDER syn. Chamaecyparis nootkatensis (D. DON) SPACH) appear in different positions within Cupressus, therefore the genus has to be included in Cupressus.

### P0921. Jurassic *Araucaria*from the sauropod dinosaur bonebed at Howe Ranch, Wyoming: the power food of the giants?

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Nearly all specimens of a new flora from a dinosaur bonebed (G Quarry, Howe Ranch, Wyoming) in the Late Jurassic Morrison Formation pertain to various plant organs of *Araucaria*.Large, squat cones with partially fused ovuliferous scale-bract complexes which are shed at maturity represent the ovulate strobili. The ligulate, unwinged, single-seeded nature of the cone-scale complexes and the detached unwinged seeds show similarities to the extant species *A. bidwillii*,Section *Bunya*.Slender cones with long-bristled cone scales are likely microstrobili. Branches and twigs bearing rhomboidal, scale-like leaves of the form genus *Brachyphyllum*represent araucarian foliage and hint at locally arid conditions. Coniferous wood is also present in large quantities. Fermentation experiments with material from extant *Equisetum*,ferns, tree ferns, conifers, and selected basal angiosperms indicate that modern leaves of *Araucaria*spp. have a comparatively high energy content and nutritional value for browsing herbivores. Virtually the only fossil plant at the site, *Araucaria*may have played a major--if not exclusive--role in the diet of these gigantic sauropods.

### P0922. Genetic variation of *Ginkgo biloba* based on RAPD, ISSR and PCR-RFLPs

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*Ginkgo biloba* is referred as a "living fossil" plant. As a wild species, it is native to China. Patterns of cpDNA variation were studied in 220 individuals from 15 populations inside and outside China. Six populations in China were selected to analyze population differentiation using ISSR and RAPD markers. Results show *PPB* = 73.86% in ISSR and *PPB* = 68.04% in RAPD. Combined data indicated relatively high $H_E$ = 0.2408, *Ho* =0.3599 in species level. Possible natural populations possessed higher genetic diversity. Differentiation among populations is 28%. Restriction analysis of PCR-cpDNA fragments was employed to identify the distribution of haplotypes. There were 19 haplotypes in two combinations. Hapotype A was the most frequent haplotype, found in all populations. Haplotype B, G and H represented 11.4%, 16% and 5% of the total samples. Other 15 haplotypes were very rare, but some of them were informative. Distribution of haplotypes revealed diversity center lies in Guizhou and Congqing of Southern China, possible natural populations. Combined ecological and genetic data, Two conservative strategies are proposed.

### P0923. Fine morphology of peculiar reticulate pollen from the Permian of Russia

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The morphology of dispersed pollen of Reticulatina from the Permian of the Russian Platform was studied. We found individual pollen grains showing reticulate pattern both under LM and SEM (group 1) and a different set of specimens (group 2) with the inner reticulum visible only under LM. With SEM, group 1 exhibits a coarser reticulum in the center of the pollen grain and a finer peripheral reticulum. The ectexine includes perforated tectum, spongy infratectum with rather regular short partitions, and foot layer. The thick endexine appears nearly homogeneous, but at places lamellate structures are distinguishable supporting that the endexine might have been ontogenetically lamellate. Group 2 shows a continuous and smooth tectum that completely hides the underlying layers when examined with SEM. Differing in the ultrastructure of ectexine, they are similar to group 1 in the endexine morphology. Although the pollen grains are of gymnospermous affinity, the similarity between the surface of Reticulatina (group 1) exine and that of Cretaceous angiosperm pollen is fascinating. The study is supported by the RFBR, no. 03-04-49611.

### P0924. Morphology and development of seeds of *Zamia amblyphyllidia* D.W.Stev. (Cycadaceae) and *Ginkgo biloba* L. (Ginkgoaceae)

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Our investigations about the female reproductive structures of *Zamia ambliphyllidia* D.W.Stev. and *Ginkgo biloba* L. were focused on the initiation and the development of seeds. Studies were done by SEM and LM to compare the results with previous studies in other gymnosperms. These results show various similarities within all members of Cycads and *Ginkgo*, but several differences to the morphogenesis of seeds in most Conifers. The differentiation of the integument in a stony sclerotesta and a fleshy sarcotesta in *Ginkgo* and Cycads has been mostly regarded as a derived feature. A detailed comparison of these two taxa should show whether this resemblance is a homology or not, and if it has to be regarded as a plesiomorphic or an apomorphic character within gymnosperms. It is apparent that the sarcotesta in both Cycads and *Ginkgo* is not homologous to the sarcotesta in *Cephalotaxus*. The latter appears to be homologous to the aril in other Taxaceae.