Poster session b1

BRYOPHYTES AND PTERYDOPHYTES

Spore morphology of Cuban species of *Asplenium* (Aspleniaceae, Pteridophyta)

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Asplenium L. is a cosmopolitan genus with ca. 700 species widely distributed in almost all the continents and both hemispheres. There are 37 species in Cuba displaying a large range of morphological variability.

After finishing the taxonomic treatment of *Asplenium* for the new "Flora de la República de Cuba", a spore survey was carried out in order to assess the spore morphology characters for the resolution of some taxonomical problems that still remained.

The species were divided in eight groups regarding their macro-morphology. All the species were examined with LM and SEM and the spore morphology was compared within each species complex. The terminology to describe the perispore morphology, used before for other complexes of *Asplenium* species, was revised and compiled.

After this analysis three patterns of perispore macro-ornamentation were recognized: folded, spinulose and reticulate and five patterns of surface micro-ornamentation: laevigate, perforate, fenestrate, venate and echinulate.

In some groups of species such as I, II and IV, a consistent pattern among the species was observed, varying mostly in perispore micro-ornamentation and type of folds margin.

In other groups such as III, VI, VII and VIII, spore morphology provides consistent characters that enable us to distinguish at the species level.

Role of sporoderm ornamentation in the taxonomy of some selected Indian hornworts (Anthocerotae)

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Sporoderm ornamentation plays a significant role in the taxonomy of hornworts, in addition to their gametophytic features. A variety of sporoderm patterns ranging from papillose to perfectly reticulate typically signifies the specificity of each taxon up to species level. A study made on Indian *Anthoceros* (Micheli) L. em. Prosk. and *Phaeoceros* Prosk. is presented here. The Indian species of *Anthoceros* have been broadly grouped in two categories on the basis of the sporoderm patterns: 1. Spores with an unsculptured stripe along the laesurae on the proximal face; 2. Spores without this unsculptured stripe along the laesurae on the proximal face. The taxa falling within the first category i.e. *A. alpinus* Steph. and *A. bharadwajii* Udar *et* Asthana are characterized by a reticuloid-pseudolamellate or lamellate sporoderm, while *A. erectus* Kash. is characterized by a reticulate sporoderm with bold muri enclosing 3-5 lumina. The second category includes *Anthoceros angustus* Steph. with spinulate-baculate-reticuloid spores, *A. punctatus* L. and *A. crispulus* (Mont.) Douin with reticulate (rather pitted) spores, *A. subtilis* Steph. with granulate-baculate spores, *A. macrosporus* Steph. and *A. pandei* Udar *et* Asthana with a thick lamellate sporoderm. As far as the sporoderm architecture in the genus *Phaeoceros* Prosk. is concerned it is sharply distinct from that of *Anthoceros* in possessing pale-yellow spores with minutely papillose to lamellate projections and a prominent equatorial crassitude. e.g. *Phaeoceros laevis* (L.) Prosk. and *Phaeoceros carolinianus* (Michx.) Prosk. are characterized by a minutely papillate sporoderm; *P. udarii* Asthana *et* Nath has

minute tubercles on the elaters as well, while *P. himalayensis* (Kash.) Prosk. and *P. kashyapii* Asthana *et* Sriv. possess hump-like and lamellate projections on the sporoderm surface respectively. A critical investigation has revealed that the sporoderm pattern can be convincingly relied upon for systematic treatment of hornworts.

Morphology and ultrastructure of microspores of *Isoetes* species (Lycophyta) from Southern South America

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The microspore characteristics of 24 species of *Isoetes* L. that grow in Southern South America are presented as part of a study that aims at making a broad revision of this genus in the region. They are: *I. alcalophila* Halloy,

I. andicola (Amstutz) Gomez, *I. boliviensis* Weber, *I. bradei* Herter, *I. brasiliensis* Fuchs, *I. chubutiana* Hickey, Macluf & Taylor, *I. ekmanii* Weber, *I. escondidensis* Halloy, *I. eshbaughii Hickey*, *I. fovosa* Hickey, *I. fusco-marginata* Fuchs, *I. gardneriana A. Braun*, *I. herzogii* Weber, *I. hieronymii* Weber, *I. itaboensis* Fuchs, *I. lechleri* Mett., *I. panamensis* Maxon & Morton, *I. pedersenii* Fuchs, *I. ramboi* Herter, *I. savatieri* Franchet , *I. sehnemii* Fuchs, *I. smithii* Fuchs, *I. spannagelii* Fuchs and *I.weberi* Herter.

The analysis was performed with scanning electron microscopy (SEM) and transmission electron microscopy (TEM). The microspores are monolete, elliptic in polar view and bi-convex in equatorial view, 30 to 40 µm long and 20 to 30 µm wide.

The microspore wall in section is composed of perispore, para-exospore, exospore and endospore. The perispore is more contrasted than the exospore. The perispore thickness varies depending on the area of the spore. It is thinner proximally and thicker distally with high processes protruding outwards. In section, it is composed of three strata. The middle stratum constitutes the main part of this layer and is composed of one or several sub-strata depending on its type of structure, which may be either lax or camerate. The outer stratum has discontinuities and bears the ornamentation. When viewed in section, the exospore shows two levels. The inner level has a compact structure except for the multi-stratified areas at both sides of the aperture. The outer level or para-exospore is composed of either laminae or bars with darkly contrasted edges, which are discontinuous at the top of the supra-laesural expansion. In section an equatorial-distal separation between the two parts of the exospore is evident. The perispore and outer part of the exospore take part in the formation of the supra-laesural expansion. The endospore below the exospore has a fibrilar structure.

These species produce microspores with a variety of ornamentations including elements such us granules, verrucae, ridges, cones, echinulae, echinae and tubercles. Three patterns of ornamentation are the most frequent ones: Echinate (*I. andicola, I. bradei, I. chubutiana, I. eshbaughii, I. hieronymii, I. pedersenii* and *I. weberi*); Tuberculate (*I. alcalophila, I. boliviensis, I. lechleri)* and Rugulate (*I. ekmanii, I. fovosa, I. gardneriana, I. itaboensis, I. panamensis* and *I. smithii*). It was found that the characteristics of the background are important in these species. The background is generally composed of perforations and low size sculptural elements which have the same or diverse shape respect to the major ones. There is a variation in the ornamentation on both polar faces also in these species. In general, the sculptural elements are lower and more spaced proximally being similar to or different from those of the distal face. The equatorial area has unique characteristics, some species have a projection (expansion or ridge) while others have an ornamentation transition.

As a result of this study it was found that there are general as well as ultrastructural characteristics that could be useful for systematic purposes at infra-generic level. They are: ornamentation differences on both polar faces, like in, *I. alcalophila, I. boliviensis, I. bradei, I. chubutiana, I. eshbaughii, I. escondidensis, I. herzogii, I. hieronymii,*

I. lechleri, I. pedersenii, I. savatieri and *I.weber*. These variations include, shape, size and number of sculptural elements. Another important aspect is the characteristic of the equatorial or sub-equatorial area. Among the characteristics of the ultrastructure, the perispore complexity and its organization as well as the nature of the para-exospore structural elements should be mentioned. By combining all these characteristics it was possible in some cases to arrive at species group and in some special cases at specific level.

From the available chromosomic data it was also found that there is a positive correlation between the increase of the ploidy level and the microspore size, as it occurs in *I. chubutiana*.

Spore morphology of pteridophytes from Valley of Mexico, Mexico

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The Valley of Mexico is situated in the center of Mexico (19°02' and 20°12' latitude N; 98°32' and 99°32' longitude W). In this valley we found 18 families, with 40 genera and 113 species of pteridophytes. There are four heterosporous families (Selaginellaceae, Isoëtaceae, Marsileaceae and Salviniaceae) and 14 isosporous families (Aspleniaceae, Blechnaceae, Dennstaedtiaceae, Dryopteridaceae, Equisetaceae, Grammitidaceae, Lomaropsidaceae, Ophioglossaceae, Plagiogyraceae, Polypodiaceae, Psilotaceae, Pteridaceae, Thelypteridaceae and Woodsiaceae). We describe the spore morphology of all the species.

In this work we include descriptions and lightmicrographs of spores taking in consideration the presence of isosporous or heterosporous spores, aperture type, spore shapes in proximal and distal view, exospore and perispore ornamentation, perispore thickness, presence or absence of crests and folds on the perispore, and presence or absence of a laesural margo. Also a key for determination of the taxa is included, and the taxonomic position of some taxa is discussed based in spore morphology.

It appeared to be possible to distinguish through the spores 60% of the taxa here studied. The genera with very similar spores were the cheilanthoid group (*Astrolepis, Bommeria, Cheilanthes, Mildella*), as well as the genera *Campyloneurum, Polypodium, Pleopeltis* and *Pecluma*. Using spore morphology we were able to determine the genera *Selaginella, Thelypteris, Pteris* and *Pellaea*.

New data in relation to the fertile frond and the spore maturation process in *Weichselia reticulata* (Stokes et Webb) in Ward emend alvin Fern

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Weichselia reticulata is widely distributed, both in space and time. This tree fern is known from the Bathonian to the Cenomanian and has been reported from Europe, North of Africa, Middle East, Siberia, India, North America and South America. Despite its widespread distribution, fertile fronds with *in situ* spores are very scarce.

In the village of Escucha (Teruel) an exceptional record of fertile structures of *Weichselia reticulata* has been found; this fertile material was found in deltaic deposits belonging to the Middle Member of the Escucha Formation and Albian in age (AGUILAR et al, 1971). It consists of several rachises containing soral clusters, spherical in shape, alternately arranged and composed of 12 to 24 sori; each sorus is covered by a peltate indusium of polygonal shape.

The palynological analysis of the *in situ* spores shows a morphologycal variation in relation to the stage of maturity inside the sporangium.

These results are similar to those described by ALVIN (1968) for the spores already mature. Nevertheless in our case we also observe isolated spores from immature sori of *Weichselia reticulata* (still not detached). In this way, different morphologies are distinguished for each Ontogenetic Development Stage (ODS) in relation to the structure, size and shape of the spores.

There are some controversial aspects due to the classification of spores of *Weichselia reticulata*. ALVIN (1971) suggested that spores of this tree fern have been described dispersed as *Biretisporites potoniaei* by DELCOURT & SPRUMONT (1955) and DELCOURT, DETTMAN & HUGHES (1963), but it appears with differences from those described by us. Although most authors would identify these dispersed spores as *Matonisporites*

COUPER (1958), DÖRING (1965) considers it to be a *Triloboporites*. The characteristics of the spores described from the Escucha Formation resemble *Toroisporis* (*Crassiangulisporis*) *planatorosus* described by DÖRING (1964) due to the greater thickness of the exine at the angles than at the sides.

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ALVIN, K.L., 1971. Weichselia reticulata (Stokes et Webb) Fontaine from the Wealden of Belgium. *Memoire de l'Institut Royal des Sciences Naturelles de Belgique*, 166, 33 pp.

COUPER, R. A. 1958. British Mesozoic microspores and pollen grains. *Palaeontographica*, B, 103, 75-179.

Poster session b2

SPERMATHOPHYTE POLLEN: EVOLUTION, PHYLOGENY AND SYSTEMATICS

Palynological affinities between cultivated crops and their wild allies- a substantial approach in crop taxonomy

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In palynological studies, the characteristic morphological features of pollen exine which is specific in relation to plant taxa forms the basis for its applicability in plant taxonomy. Poaceae among the monocotyledons and the legumes among the dicotyledons constitute some major crops and studies in pollen morpho-features including ultrastructure in some genera of the two families have provided some important information of taxonomical relevance which can be used in delimitation of taxa in subgeneric level as well as in tracing affinities of cultivated species with their wild allies and progenitors. Interrelationship among the taxa were based on studies conducted in the genus *Oryza*, *Saccharum*, and *Sorghum* of Poaceae and *Cajanus*, *Atylosia*, and *Cicer* of Leguminosae. Exine ultrastructural studies in 19 species of *Oryza* (VAUGHAN 1989) showed three basic types of surface ornamentation e.g. granulose, spinulose and insular which were further categorized according to aggregation of surface excrescences. The study revealed that section *Sativa* comprising cultivated and wild species possess largergrains than other sections of the genus. Size wise, the grains of Asian cultivated species *O. sativa* race Indica is closer to its wild relative *O. nivara* and the African cultivated species *O. glaberrima* and its wild relatives *O. barthii* and *O. longistaminata* have uniform size denoting palynological affinities among the taxa. In *Sorghum*, pollen ultrastructural studies presumes that cultivated *Sorghum* (series *Sativa*) might have evolved from the species of the series *Spontanea* which contains wild grass. Both of the above series are included in the subsection *Arundinacea* under section *Eu-sorghum* (MOENCH 1794) and contain pollen having both granular and insular exine surface pattern. Pollen ultrastructural studies in cultivated and wild species of *Saccharum* have also shown distinguishing exine surface patterns of taxonomic importance. Examination in size parameter in the genus indicates a distinct palynological affinity between the cultivated species *S. officinarum* and its wild ally *S. robustum* as both have larger grains with wider size range than other species of the genus. This may be considered as a palynological evidence in support of GRASSL's (1946) view that *S. robustum* is a wild cognate ancestor of *S. officinarum*. Despite of the strictly stenopalynous nature of the above three Poaceous genera which is limiting factor of palynological differentiation, ultrastructural characterization in subgeneric level and congruence in size factor provided conclusive evidences of affinities between the cultivated species and their wild progenitors. In legumes, pollen morphological similarities with regard to aperture and exine ornamentation identified between