PHENOTYPE OF SOME *PAPAVERACEAE* SPECIES EXPRESSED AS MICROMORPHOLGY OF FOLIAR LAMINA AND CAPSULE SURFACE

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Abstract: In the present paper, the micromorphological particularities of the capsule and foliar lamina are described at four species from *Papaveraceae* family: *Chelidonium majus* L., *Glaucium flavum* Cr., *Papaver rhoeas L.* and *Papaver somnifemm* L., in order to identify at a species level, the specificity of these features.

Key words: *Papaveraceae*, foliar lamina, capsule, micromorphological specificity

BRIEF HISTORY OF THE RESEARCHES ISSUED IN THE CUTICULAR AND EPICUTICULAR MICROMORPHOLOGY

In the last two decades, the issues of microstructure details of the cuticle and epicuticular wax, their functional and taxonomical signification have been highly studied because of the large application of the electronic microscopy, especially of the scanning electron microscopy (SEM). High and serious researches were made at the Botanic Institute of the Botanic Garden from Bonn. There was elaborated one of the most complete and comprehensive synthesis regarding the bibliography related with the cuticular and epicuticular surfaces of the plants /4/

Regarding the diversity of the so far studied aspects, we are presenting bellow just few of them, which may motivate our attention upon the analysis of the micromorphological details at those four *Papaveraceae* species:

The descriptive terminology for the micromorphological diversity of the epicuticular sculptures was set up by Metcalfe, Chalk (1979) and Barthlott (1998) /cf.2 /

The detailed structure and the chemical composition of cuticle was analyzed by Bowen and Walton,1988; Riederer and Schonherr, 1988, the water permeability by Becker et al. 1986, and the sorption properties of cuticle by Riederer and Schonherr 1986; Schonherr and Riederer, 1986.

Cuticular ridges or cuticular folds, which occur frequently on the surfaces of the most angiosperms, were analyzed by Cheng et al., 1986. However, we are far from understanding the patterns of cuticular ornamentation in many species.

In 1986, Jeffree provided a synthesis of the data regarding the epicuticular wax and the protection hairs from the plants' surfaces /cf.4/

For a long time, the surface features of the plants were considered as simple devices for the reduction of the water loss. Subsequently, it became obvious that the enormous structural diversity of the micro-sculpturing in terrestrial plants is linked to a corresponding functional diversity: temperature control during insolation period, optical properties, wettability and decrease of the contamination capacity.

The functional particularities of the cuticle were analyzed at different angiosperm groups. They are concerning the structural-functional interconnections between stomata features, epicuticular wax and transpiration. (Gomes and Kozlowski, 1988).

The description of the environmental pollution's effects on cuticular surfaces, in particular in connection with acid rain in Central Europe and Nordic countries as well as the structural mutation due to the dust on leaves and petals (Eveling 1986), bauxite and cement was analyzed by Eveling, 1986 and Dixit, 1988./cf. 4/

Baker and Hunt, 1986 could demonstrate that acid rains accelerate the wax erosion velocity, features studied especially within the boreal forests and upon species with high economic importance. (Caporn şi Hutchison, 1986; Crossley and Fowler, 1986; Gaber and Hutchison ,1988 ; Hutchison and Adams , 1987; Nebe et al. , 1988 and Percy, Baker ,1987). The structural degradation of the epicuticular wax is accelerated by ozone at *Picea abies* (Barnes et al. 1988) /cf.4/

It could be demonstrated (Noga et al. 1987; Wolter et al. 1988a) that the application of the surfactants can alter the fine structure of epicuticular wax and, subsequently, increase the wettability of leaves, and, respectively, the increase tendency of the contamination ability. This issue is important in the application of the pesticides.

A major practice importance is linked to the usage of the cuticular features in taxonomy. In this regard, data and graphs concerning epidermal and cuticular surfaces taken by SEM were undertaken and included in the most modern taxonomic and systematic treatises /3/

The taxonomic applicability was discussed for foliar surface by Stace,1984 and for the seminal layer by Barthlott, 1984 ; Boulter, 1986 added short notes on fossil seeds.

The anatomy treatises contain micrographs of the epicuticular surfaces that belong to ancestral angiosperm orders as: Magnoliales, Illiciales, and Laurales (Metcalfe, 1987).

The comparative micromorphology of epicuticular waxes in the orders Caryophyllales (Engel and Barthlott ,1988) and Rosales (Fehrenbach and Barthlott,1988) provides limited criteria for the classification of these groups (cf.3/

In the monographic treatise upon the waxes at monocotyledons, using high resolution SEM, it could be demonstrate that fine structure and orientation of the crystalloids are new characters of high taxonomic significance: in several cases, a circumscription of taxa between the genus and superorder level is possible, and the position of several families was also elucidated (e.g.Velloziaceae, Burmanniaceae; Araceae in relation to Arecaceae) /3/.

MATERIAL AND METHOD

The analyzed material consists in fragments of foliar lamina that belong to four *Papaveraceae* species*: Chelidonium majus* L., *Glaucium flavum* Cr., *Papaver rhoeas L.* and *Papaver somnifemm* L. The exterior surface of the capsule was also examined at *Glaucium flavum* Cr., *Papaver rhoeas* L. şi *Papaver somniferum* L.

The material comes from experimental cultures, harvested in 2001. The analyzed fragments come from the median side of the foliar lamina, respectively, of the capsule.

The samples were dehydrated through physical methods, stick on aluminum supports, thereafter plated with silver /5/. The metal's evaporation in vacuum was provided by the Electronic Microscopy Laboratory, within the Faculty of Light Industry, "Gh. Asachi" Technical University of Iasi.

The graphs provided by the Tesla BS-300 scanning electron microscope were undertaken over a high resolution monitor and they were photographed with a Praktica camera.

RESULTS OF THE OBSERVATIONS

The aspects indicated in the above Brief History represented both the theoretical basis, issue of the present paper, and the premises which set up the objectives of our research:

- Identify the micromorphological features of the surfaces of the foliar lamina and capsules for *Papaveraceae* species
- Setting up the specificity level of these features, on a taxa or organ level

Achieving these objectives, the ulterior researches propose to determinate in which proportion the micromorphological features of the analyzed seeds remain constant under the treatment with biodestructive substances. If there are any modifications, we propose to identify the functional consequences that may occur and, of course, their practical connotation.

Therefore, the present paper is a part of a larger cytogenetic and physiologic research, which tries to bring out the issue of phylogeny in *Papaveraceae.*

Micromorphology of the foliar lamina's surfaces

At *Chelidonium majus* L. (Pl. I.- 1)

- On a general examination – the surface of the foliar lamina is pleated; it may be observed the limits of the epidermal cells and the slight pleated aspect of the external tangential walls;
- The cuticular surface of the foliar lamina is relatively dense and uniformly covered with wax conglomerates with a granulated aspect.

At *Glaucium flavum* Cr. (Pl. I. – 1, 2)

- On a general examination (Pl.I. - 1) – the cuticular surface of the lamina is almost compact covered with crystalloids that bring a granulated primary relief;
- On a detailed examination (Pl.I.- 2) a secondary relief is visible. It has a fine lamellar-filamentous aspect; here and there, crystalloids interpenetrate in more compact nodular forms.

At *Papaver* genus (Pl. III.)

- The epicuticular morphology is relatively similar, having mainly a lamellar type; comparative with the morphology described at *Glaucium flavum* Cr., the crystalloids appear in clearer delimited conglomerates, that leave among them amorphous cuticular places
- At *Papaver rhoeas* L., crystalloids appear in more compact groups than at *Papaver somniferum* L.; the cuticle has a uniform aspect, smoothy by the anticlinal walls.

At *Papaver rhoeas* L., the epidermal cells have a clearer delimited profile, the anticlinal walls being more visible than at *Papaver somniferum* L.

Micromorphology of the capsule's wall

Regarding the capsules' micro-relief, it is noticeable that particular features appear at those two species of *Papaver* (Pl.IV), comparative with the identified ones on the lamina level.

These ones refer to:

- Presence of long linear crystalloids here and there overlapped and interpenetrated. They leave among them visible amorphous surface zones.
- At *Papaver somniferum* L., crystalloids are thicker, often interweaved. They cover each other within a relatively compact coat, or they are visible longer and dispersed distributed.
- At *Glaucium flavum* Cr. (Pl. III.) the surface details of the capsules are slightly different than the foliar micromorphology.
- The capsules' cells are covered with a uniform and dense wax layer, which is a lamellar type with a compact tendency on a detailed examination.

CONCLUSIONS

For the species that belong to *Papaver* genus, the general aspect of the foliar epicuticular relief is similarly.

Slight differences appear regarding the compact level of crystalloids, but ampler differences appear between the foliar and capsules' micromorphology.

Between the species that belong to different genus, the differences regarding the lamina morphology are clearer and they are related with the distribution type of the crystalloids, that varies from compactness *(Papaver)* up to a relatively uniformity *(Glaucium)*.

Between the micromorphology of the foliar lamina and capsules, less visible differences appear to *Glaucium flavum*.

The phenotype of some morphological features of the foliar surfaces and capsules, determined upon genus, may represent a supplementary criterion and reason for a correct systematic position of the species.

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Plate I

Micromorphology details of the foliar lamina

1. Chelodonium majus – upper epidermis (x 990)

2. Glaucium flavum – lower epidermis (x 610)

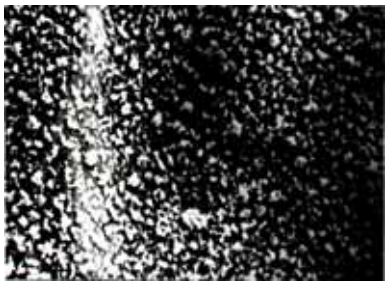
3. Glaucium flavum – lower epidermis (x 3000)

Plate II

Micromorphology details of the foliar lamina

1. Papaver rhoeas – upper epidermis (x 610)

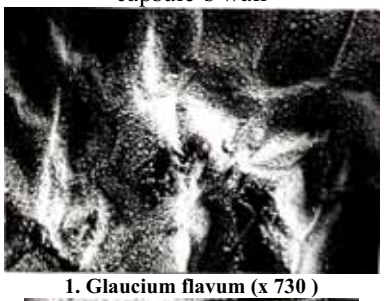
2. Papaver rhoeas – upper epidermis (x 2900)



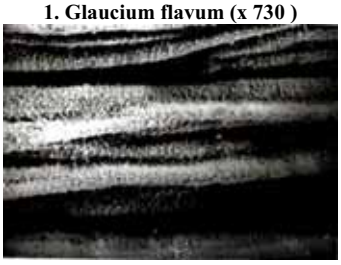
3. Papaver somniferum – upper epidermis (x 3000)

Plate III

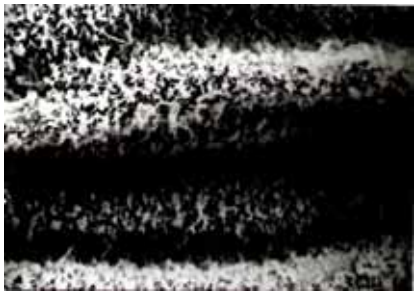
Micromorphology details of the capsule's wall



1. Glaucium flavum (x 730)



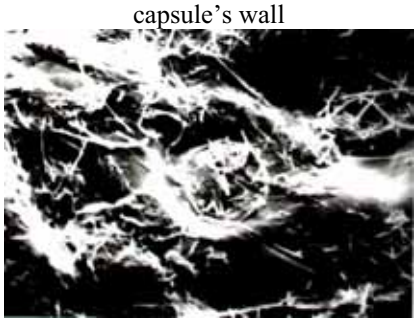
2. Glaucium flavum (x 3000)



3. Glaucium flavum (x 3000)

Plate IV

Micromorphology details of the capsule's wall



1. Papaver rhoeas (x 3000)

2. Papaver somniferum (x 3200)