ACTA BIOLOGICA SZEGED. 24 (1–4), pp. 19–22 (1978)

ULTRASTRUCTURE INVESTIGATIONS INTO FOSSIL SALVINIACEAE SPORES

M. KEDVES

Department of Botany, Attila József University, Szeged

(Received January 14, 1977)

Abstract

In this paper the results of the transmission electron microscopical examinations of an upper Cretaceous Salviniaceae sporangium fraction are summarized. The ultrastructure of the general enough spongious intermediary substance is at first described, as recognized at the fossil Salviniaceae spores, in the course of the light-microscopical examinations. The submicroscopical structure of the spore-wall is identical with the "modern type" from the upper Cretaceous, lower Paleogene Period, viz. two layers on the spore-wall can only be distinguished on the basis of the electron affinity.

Introduction

The first data on the submicroscopical structure of the wall of the fossil spores were published by PETTITT (1966). Then KEDVES and PÁRDUTZ (1973) established on Schizaeaceae and Gleicheniaceae spores from the upper Cretaceous and lower Tertiary Periods that the two layers (ectexosporium, resp. endexosporium) can only be isolated on the basis of electron affinity. The spore-walls of this Period significantly differ in respect of ultrastructure from those of the Palaeozoic Era and in point of building up they are simpler. KEMPF (1969 a, b, 1971) investigated into the submicroscopical structure of the micro and megaspore-walls of the fossil *Azolla* and *Salvinia*. He established about the structure of the perine (1969a) that the tectum, the columella layer, and the foot layer are similar in their arrangement to the sporodermis of Angiospermae. The detail of the wall below the perine, the ectexosporium in these spores agrees essentially with the type observed by us, as well.

Materials and Methods

In the course of our investigations into the ultrastructure of the fossil spore-pollen exine, we found in one of the blocks embedded forms from the upper Cretaceous sediments of the Farafra oasis, a sporangium fraction of which, with a light microscope, the fgen. of Hydrosporis can be recognized. The detailed description of the method of this investigation is to be found in the paper of KEDVES and PÁRDUTZ (1970).

Plate 1

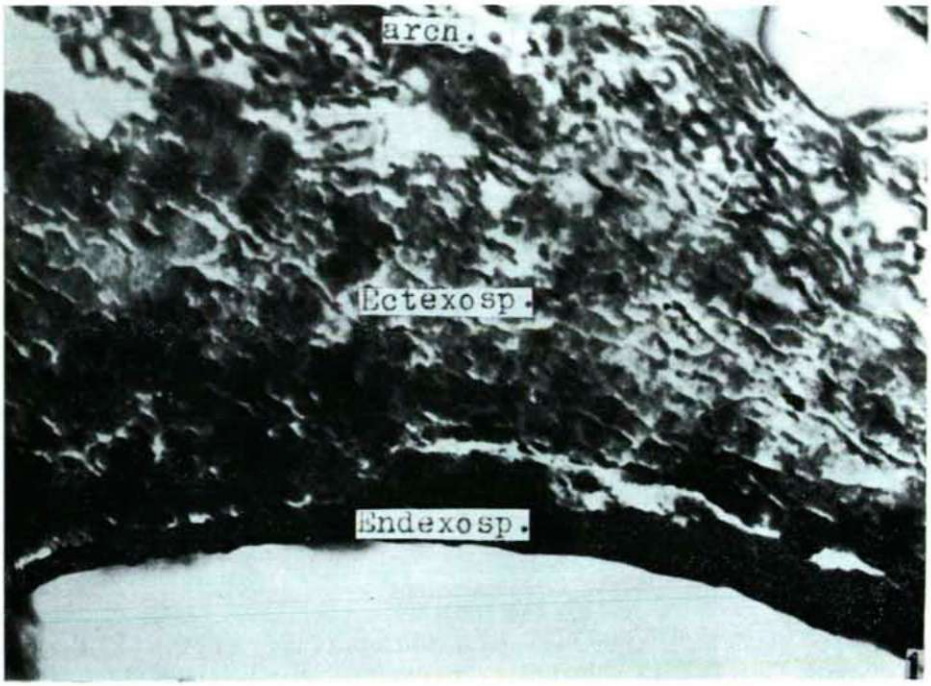
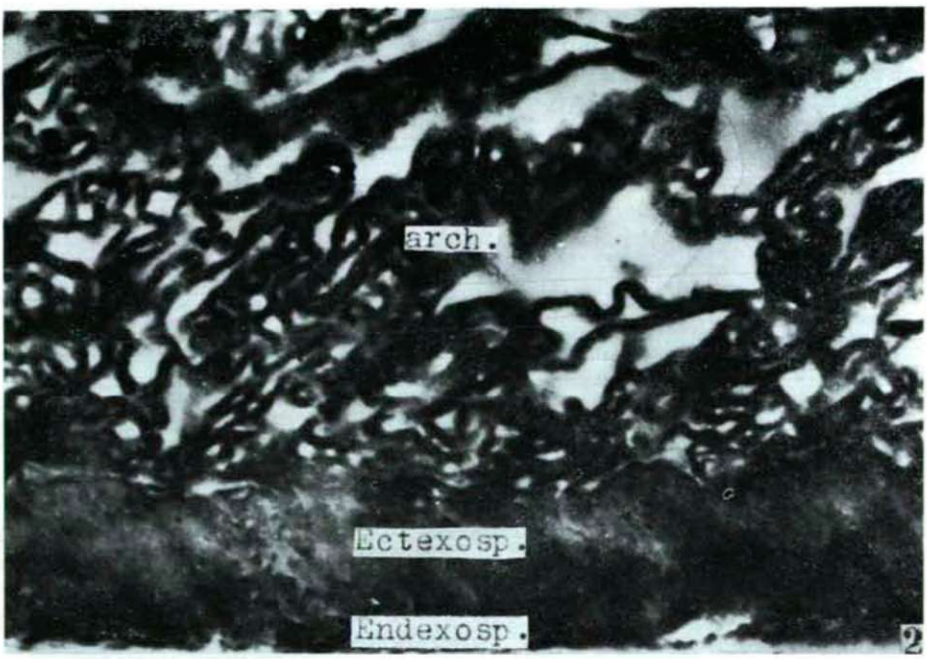


Plate 2



Results

The intermediary substance surrounding the spores being probably the remainder of the archesporium, is mostly of lamellar ultrastructure (Plate 1, 2). Between the lamellae there are sporadically in our crossectional picture also some tiny submicroscopical formations, with an elliptical shape.

In respect of the ultrastructure of the spore-wall, we could establish two types: In case of the first type the external part of the wall is in a very close connection with the lamellar part of the archesporiumwall. The transition between archesporium and ectexosporium is often almost continuous. This is the cause of that the sectional picture of the ornamental elements of the surface cannot be observed at this type. The ectexosporium is of expressly lamellar structure, the single lamellae are much thicker than the lamellae of the intermediary substance and very often anastomose. The endexosporium is of very strong electron affinity, homogeneous, in this case, the difference between ectexosporium and endexosporium is very express (Plate 1).

At the other type, in the external part of the spore wall, the sectional picture of the surface ornamental elements is to be observed well. The surface is uneven, there are protrusions on it, the decoration is probably granular. The surface of the ectexosporium is well-isolated from the lamellae of the archesporium. As to its substance, as opposed to the former type, it is homogeneous. The electron affinity of the endexosporium is of much lower degree in this case than at the former type. In this case, even the section of the laesura of the tetrad mark was successful. This is a narrow cleavage covered by the outermost layer of the ectexosporium.

Discussion

POTONIÉ (1962) was writing in his monograph, written on the light-microscopical structure of the associated sporomorphs at the Salviniaceae, about an intermediary substance of spongy structure at Palaeozoic forms, as well. On the one hand, he establishes that microchemically this is similar to the sporopollenin, on the other hand, that it does not belong to the structure of exine. This establishment is supported by our ultrastructure investigations, added anyway that, in case of this intermediary substance, the question in point may have been the archesporium, namely a well fossilized part of that. As to the ultrastructure of the wall of spores, it essentially agrees with the earlier recognized "modern type" which is homogeneous, without any articulation. The endexosporium only differs from the ectexosporium exclusively by its electron affinity. On the basis of the foregoing results from a younger age we must accept the result that, in case of the modern fossil Pteridophyte spores, the ultrastructure is not differencing value, in contradiction to those described from the Palaeozoic Era where more than one type can be separated. This may have followed from that the undifferentiated fern taxa of the Palaeozoic Era have produced more types also in respect of ultrastructure than the already differentiated forms from a younger age. As regards the two types to be established in the ultrastructure of the spore wall, we may first of all think on that the maturity state of the spores occurring in the massula is different, namely in case when the connection between the remains of ectexosporium and archesporium is very close that is representing a more immature state as opposed to the well-differentiated spore wall.

Hydrosporis fsp.

Plate 1. — A detail of the spore wall. The lamellar ultrastructure of the ectexosporium is express. M: ×25.000

Plate 2. — Ectexosporium of homogeneous ultrastructure. M: ×25.000

arch. = archesporium
Ectexosp. = ectexosporium
Endexosp. = endexosporium

References

KEDVES, M.—PÁRDUTZ, Á. (1970): Etudes palynologiques des couches du Tertiaire inférieur de la Région Parisienne VI. Ultrastructure de quelques pollens d'Angiospermes de l'Eocène inférieur (Sparnacien). — Pollen et Spores *12*, 553—575.

KEDVES, M.—PÁRDUTZ, Á. (1973): Ultrastructure examination of fossil Pteridophyta spores and Gymnospermatophyta pollens. — Acta Bot. *18*, 307—313.

KEMPF, E. K. (1969a): Elektronenmikroskopie der Sporodermis von käinozoischen Megasporen der Wasserfarn-Gattung Azolla. — Paläont. Z. *43*, 95—108.

KEMPF, E. K. (1969b): Elektronenmikroskopie der Megasporen von *Azolla tegeliensis* aus dem Altpleistozän der Niederlande. — Palaeontographica B, *128*, 167—179.

KEMPF, E.K. (1971): Elektronenmikroskopie der Sporodermis von Mega- und Mikrosporen der Pteridophyten-Gattung *Salvinia* aus dem Tertiär und Quartär Deutschlands. — Palaeontographica, B, *136*, 47—70.

PETTITT, J. M. (1966): Exine structure in some fossil and recent spores and pollen as revealed by light and electron microscopy. — Bull. B. M. (N.H.) Geol. *13*, 223—257.

POTONIÉ, R. (1962): Synopsis der Sporae in situ. — Beih. Geol. Jb. *52*, 1—204.

Address of the author:
DR. M. KEDVES
Department of Botany, A. J. University,
H-6701 Szeged, P. O. Box 428,
Hungary