6. HIGH TEMPERATURE EFFECT ON THE POLLEN GRAINS OF LARIX DECIDUA MILL.

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Abstract

The LM morphology of fresh, and the qualitative and quantitative alteration of heated pollen grains of *Larix decidua* are presented in this paper. The non-inaperturate morphology is expressed at the secondarily altered specimens. Some of them are similar to the *Taxodiaceae* pollen grains.

Key words: Palynology, recent, *Larix decidua*, high temperature effect.

Introduction

POTONIÉ (1931) published the *Sporonites (?) magnus* for the large inaperturate fossil forms. Later POTONIÉ and GELLETICH (1933) used the name *Laevigatasporites* (?) cf. *magnus*. In 1934 POTONIÉ described the *Pollenites magnus* (syn.: 1931 *Sporonites* (?) *magnus* R. POTONIÉ, Zeitschr. Braunkohle, S. 556, Abb. 6.). As recent comparative material *Larix decidua* (ca 50–100 μ) and *Larix europea* (ca. 100 μ) were used. This nomenclature was followed in the paper by POTONIÉ and VENITZ (1934). RAATZ (1937) introduced the *Larixpollenites* genus. THIERGART (1940) published these large inaperturate forms as *Larix-Poll. magnus* R. POT., THOMSON and PFLUG (1953) as *Inaperturopollenites magnus* (R. POT.) n. comb. POTONIÉ (1958) summarized the following, p. 77:
Laricoidites (al. *Pollenites*) *magnus* R. POT. 1934
Laricoidites (al. *Pollenites*) *magnus* (R. POT.) in WOLFF 1934
Laricoidites magnus (R. POT.) POT., THOMS. and THIERG. 1950
Laricoidites (al. *Laricoipollenites*) *magnus* (R. POT.) in R. POT. 1951
Laricoidites magnus (R. POT.) in LESCHIK 1952
Laricoidites (al. *Inaperturopollenites*) *magnus* (R. POT.) in THOMS. & PFLUG 1953.

KRUTZSCH (1962) pointed out that *Pollenites magnus* R. POT. 1934 is the remnant of a planctonic organism. Later, KRUTZSCH (1971) established for these forms, as a valid form-genus the *Psophosphaera* (NAUMOVA 1937, 1938, ? 1950) ex BOLCHOVITINA 1953 "– Tertiär: *Larix/Pseudotsuga*-Typen –" *Psophosphaera pseudotsugoides* n. sp. nomen was introduced. E. NAGY (1985) described the *Laricispollenites gerceensis* n. g. n. sp.

Regarding the LM morphology of the recent taxa of the *Larix* genus, M. VAN CAMPO (1947) described in detail the pollen morphology of *Larix europaea*. She established a circular differentiation of the exine (bourrelet circulaire) as a remnant of the cappus (callote). ERDTMAN (1954) published the pollen grains of *Larix* as inaperturate. In 1965,

ERDTMAN described the distal leptoma and the proximal annular sexinous thickening (UENO, 1960), and laesura-like lists (YAMAZAKI and TAKEOKA, 1962).

GULLVAG (1966) published the exine ultrastructure of *Larix decidua*.

The above mentioned problems support the idea of a combined investigation of the pollen grains of the *Larix* genus. This is the first part within this project.

Materials and Methods

The material for investigations was collected by Á. KÁROSSY on 11.04.1996. Locality: Garden of the J. A. University. The experiments were started on 12.04.1996. Temperature 200 °C, length of time and numbers of experiments are as follows. 0': 1/7-361, 10': 1/7-362, $1^{hr.}$: 1/7-363, $5^{hrs.}$: 1/7-364, $10^{hrs.}$: 1/7-365, $25^{hrs.}$: 1/7-366, $50^{hrs.}$: 1/7-367. The slides for light-microscopical investigations were mounted in glycerine-jelly hydrated at 39.6%. 200 specimens of each sample were investigated qualitatively and quantitatively, except 1/7-365 because there were only 140 measurable pollen grains. The pictures were taken with an objective Carl Zeiss Jena, GF Planachromat HI 100x/1.25/0.17-A.

Results

QUALITATIVE DATA

The most important morphological characteristic features of the fresh and heated pollen grains during 10' are identical. These pollen grains are in turgescent state (Plate 6.1., fig. 1,2). In picture 2, of Plate 6.1., the "distal leptoma" and the "proximal annular sexinous thickening" sensu ERDTMAN (1965), after UENO (1960), cf. "bourrelet circulaire" (M. VAN CAMPO, 1947), is a remnant of the "callote" = cappa, cappus. Important qualitative alterations started after 1 hour of heating. The most important LM morphological alterations are summarized as follows:

1. After heating for $1^{hr.}$, $5^{hrs.}$ and $10^{hrs.}$ in all probability secondary morphological characteristic features appeared on the distal leptoma. Differentiations, similar to tetrad scar (Plate 6.1., figs. 3,7) and sulcus or furrow-like formations (Plate 6.1., fig. 6).

2. The so-called taxodiaceous morphology appeared after $25^{hrs.}$ of heating. This form may be identical to the "distal depressions" of M. VAN CAMPO (1947) observed on dried pollen grains.

3. The spherical form appeared again after $50^{hrs.}$ of heating (Plate 6.1., fig. 9). These forms are similar to the extremely altered forms of *Equisetum arvense* spores of the high temperature effect or Paleozoic algal cysts. These forms are contracted, the surface is hummocky (Plate 6.1., fig. 9).

Plate 6.1.

1–9. *Larix decidua* MILL. Recent.
1. Pollen grain without heating; 1/7-361.
2. Experiment No: 1/7-362, length of time: 10 min.
3,4. Experiment No: 1/7-363, length of time: 1 hr.
5. Experiment No: 1/7-364, length of time: 5 hrs.
6,7. Experiment No: 1/7-365, length of time: 10 hrs.
8. Experiment No: 1/7-366, length of time: 25 hrs.
9. Experiment No: 1/7-367, length of time: 50 hrs.

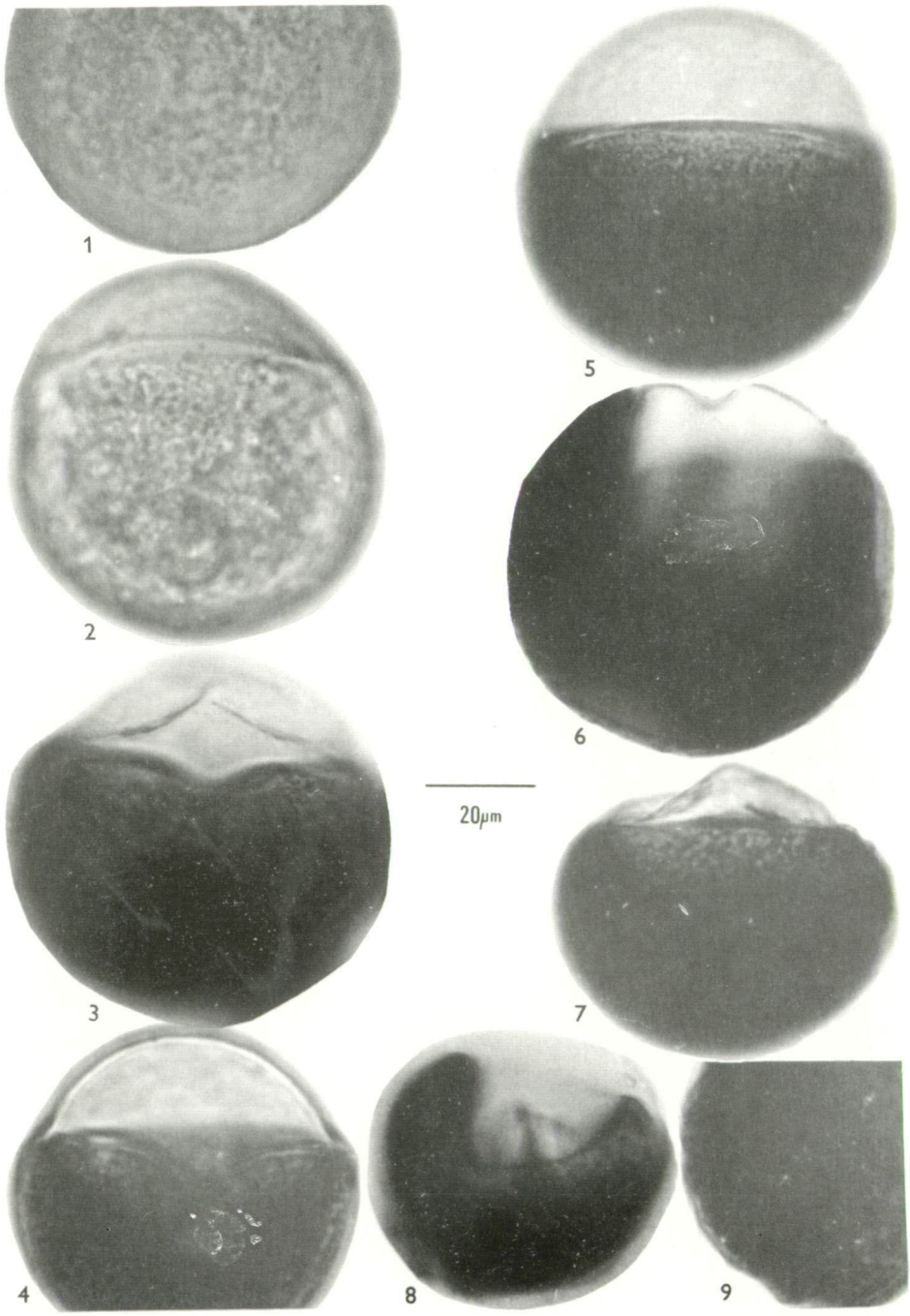


Plate 6.1.

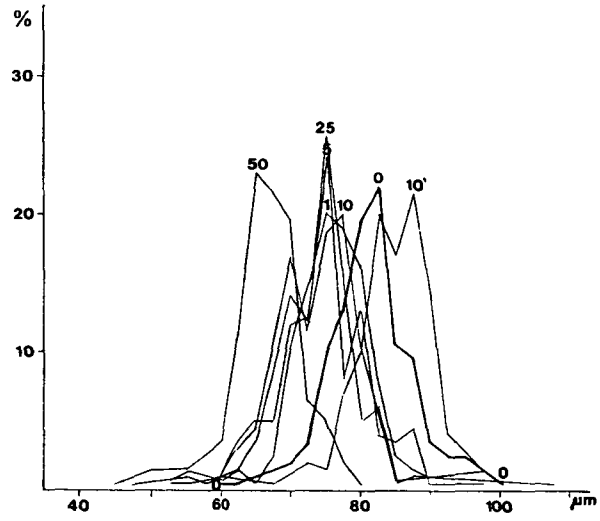
QUANTITATIVE DATA

(Text-figs. 6.1., 6.2.)

1. The pollen grains without heating are usually spherical. Diamater: 60–100 μm, L/S ratio: 1.0–1.6 (L = the longest, S = the smaller size of the pollen grain). Dominant diameter: 75.0–87.5 μm, dominant ratio: 1.0–1.2.

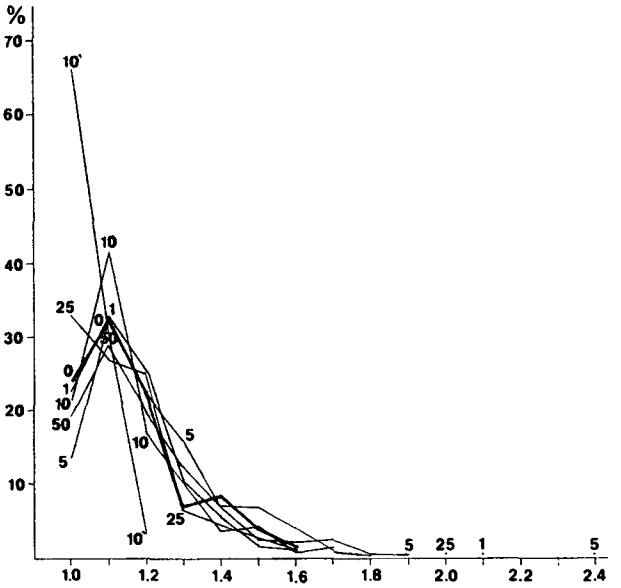
2. After 10' of heating the diameter of the pollen grains increased. The most typical pollen form is isodiametric. Diameter: 60.0–97.5 μm, L/S ratio: 1.0–1.2. Dominant diameter: 80.0–90.0 μm, dominant ratio: 1.0–1.1. The ratio value 1 is more than 66.0%.

3. After 1[hr.] the pollen diameter started to decrease. Diameter: 47.5–90.0 μm, L/S ratio: 1.0–2.1. Dominant diameter: 70.0–80.0 μm, dominant ratio: 1.0–1.3.



Text-fig. 6.1.

Larix decidua MILL. Recent. Variation-statistical graphs of the longest size of the pollen grains.



Text-fig. 6.2.

Larix decidua MILL. Recent. Variation-statistical graphs of the L/S ratio of the pollen grains.

4. After $5^{hrs.}$ of heating the diameter of the pollen grains continued to decrease, and several secondary forms were observable. Diameter: 60.0–107.5 µm, L/S ratio: 1.0–2.4. Dominant diameter: 67.5–107.5 µm, dominant ratio: 1.0–1.3.

5. After $10^{hrs.}$ of heating there were only 140 measurable pollen grains in the slides. Diameter: 52.5–97.5 µm, L/S ratio: 1.0–1.7. Dominant diameter: 70.0–80.0 µm, dominant ratio: 1.0–1.3.

6. After $25^{hrs.}$ of heating the diameter of the pollen grains increased. Results in diameter are similar to those of $10^{hrs.}$ but there are deviations in the L/S ratio. Diameter: 52.5–97.5 µm. L/S ratio: 1.0–2.0. Dominant diameter: 70.0–80.0 µm, dominant ratio: 1.0–1.2.

7. After $50^{hrs.}$ of heating the pollen grains shrinked. The amb of the pollen grains was zigzag and the colour was dark. Diameter: 45.0–80.0 µm, L/S ratio: 1.0–1.8. Dominant diameter: 62.5–70.0 µm, dominant ratio: 1.0–1.3.

The important alterations during the experiments are:

Shrinkage at heating during $1^{hr.}$, $5^{hrs.}$ and $50^{hrs.}$.

Swelling at heating during 10', $10^{hrs.}$ and $25^{hrs.}$.

The quantitative data are summarized in the following tables.

Polar axis

Length of time of heating	Smallest size in µm	Size dominant in quantity (µm)	Longest size in µm	Distance between smallest and largest specimens (µm)
0	60.0	81.45	100.0	40.0
10'	60.0	84.46	97.5	37.5
1$^{hr.}$	47.5	75.71	90.0	42.5
5$^{hrs.}$	60.0	73.47	107.5	47.5
10$^{hrs.}$	52.5	73.87	97.5	45.0
25$^{hrs.}$	52.5	74.66	97.5	45.0
50$^{hrs.}$	45.0	66.52	80.0	35.0

L/S ratio

Length of time of heating	Smallest	Dominant in quantity	Largest	Distance between smallest and largest ratio
0	1.0	1.16	1.6	0.6
10'	1.0	1.04	1.2	0.2
1$^{hr.}$	1.0	1.16	2.1	1.1
5$^{hrs.}$	1.0	1.21	2.4	1.2
10$^{hrs.}$	1.0	1.16	1.7	0.7
25$^{hrs.}$	1.0	1.14	2.0	1.0
50$^{hrs.}$	1.0	1.2	1.8	0.8

Discussion and Conclusions

The experimental results presented herein support the morphological establishments of M. VAN CAMPO (1947) on the pollen grains of *Larix europaea*.

New experiments are needed, including new TEM investigations of the experimentally altered pollen grains.

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