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POLLEN GRAINS OF PLANTS OF THE "CERRADO"
XXI — EBENACEAE, NYCTAGINACEAE,
RHAMNACEAE AND SOLANACEAE

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This paper presents the study of pollen grains of 8 species belonging to different families. Their occurrence in "Cerrados" either was assigned by Warming (1909), Ferri (1955), Rizzini (1963), or they were collected in "Cerrado" vegetation stands by the staff of our laboratory.

MATERIAL AND METHODS

The plant material used was supplied by the following Herbaria: "Instituto de Botânica de São Paulo" (SP), "Instituto Agronômico de Minas Gerais" (BHMG), and Herbarium Bradeanum (HB). The pollen grains studied belong to the following species:

EBENACEAE

Diospyros hispida A. DC.; leg.: J. F. Toledo e A. Gehrt s/n, 25/IX/1940 (SP 43186); loc.: Campo Alegre (São Paulo); det.: J. F. Toledo, conf. P. Cavalcante.

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FALANGOLA

Imprimio

Diospyros inconstans Jacq.; leg.: J. G. Kuhlmann 6669, 13/XII/1945 (SP 77372); loc.: Santa Cruz (Espírito Santo); det.: P. Cavalcante.

NYCTAGINACEAE

Neea theifera Oersted; leg.: Mello Barreto 7220, 12/IX/1932 (BHMG 1383); loc.: Santa Luzia, Lagoa Santa (Minas Gerais); det.: Mello Barreto.

RHAMNACEAE

Crumenaria polygaloides Reiss; leg.: S. M. Campos 73, 2/X/1959 (SP 64969); loc.: Município de Itapetininga (São Paulo); det.: L. B. Smith.

SOLANACEAE

Cestrum pedicellatum Sendl.; leg.: F. C. Hoehne s/n, 21/V/1927 (SP 20444); loc.: Mogy-Mirim (São Paulo); det.: J. F. Toledo, 1/IX/1943.

Solanum grandiflorum Ruiz et Pav.; leg.: J. M. Pires e G. A. Black 824, 6/XII/1945 (SP 58500); loc.: Belém (Pará); det.: J. M. Pires e G. A. Black.

Solanum grandiflorum Ruiz et Pav.; leg.: Luiz Lanstyk 34, --/II/1938 (RB 83865); loc.: Itatiaia, Benfica (Rio de Janeiro); det.: G. M. Barroso.

Solanum lycocarpum St. Hil.; leg.: M. Huger s/n, --/IV/1930 (SP 25291); loc.: Caminho do Prato (São Paulo); det.: C. V. Morton, 1942.

Schwenckia americana L. var. *angustifolia* Schmidt; leg.: E. Pereira 8858, 15/III/1964 (HB 31215); loc.: Serra do Cipó (Minas Gerais); det.: L. d'A. Freire de Carvalho.

Schwenckia americana L. var. *angustifolia* Schmidt; leg.: A. P. Duarte 7530, 25/XI/1962 (HB 45975); loc.: Varzea da Palma, Fazenda Mãe d'Água (Minas Gerais); det.: L. d'A. Freire de Carvalho.

Preparation of grains, measurements, and drawings were made by the same methods described for the species previously studied in this series (Cf. Salgado-Labouriau 1966). In all cases several flowers of the same specimen were used.

RESULTS

***Diospyros hispida* A. DC. (SP 43186)**

(Figs. 1-3)

Prolate, triangular to circular ambitus, 3-colporate, psilate grains.

Apertures: three colpi (circa. 39.9 micra long and 7.2 micra maximum wide) surrounded by margo. Colpus is wider at its ends, near de poles. Margo appears with its maximum width bellow and above the os, tapering towards colpus ends, and at the os region. Lalongate os (ca. 5.3 micra long and ca. 10.8 micra wide) with round ends not always visible in our preparations. Side of apocolpium ca. 8.4 micra; equatorial diameter in polar view ca. 34.8 micra (average of 4 grains with circular ambitus); polar area index 0.24 (minuta area).

Exine: is circa 2.3 micra, smooth; sexine (ca. 1.2 micra) as thick as nexine (ca. 1.1 micra), smooth.

Measurements.

$$P/E = 1.41$$

Magnitudes	Range (micra)	$\bar{x} \pm \frac{s}{\sqrt{n}}$ (micra)	s (micra)	V (%)
Polar diameter	42.3 - 49.2	45.9 \pm 0.4	1.8	3.9
Equatorial diameter	27.3 - 38.6	32.6 \pm 0.6	3.0	9.2

Diospyros inconstans Jacq. (SP 77372)

(Figs. 4 - 6)

Subprolate, triangular to circular ambitus, 3-colporate psilate grains.

Apertures: three colpi (ca. 27.8 micra long and 4.7 micra maximum width) surrounded by margo. Colpus is thin and keeps its width in all its length. Margo has its maximum width at the os limits and tapers towards the colpus ends; at the os region it thins out but does not disappear. Lalongate os with rounded ends; in high focuses the os appears as being triple; this aspect is caused by the dark margo of the colpus that passes over it. Os circa 3.4 micra long and 12.0 micra wide. Side of the apocolpium ca. 12.5 micra; equatorial diameter ca. 27.1 micra; polar area index 0.47 (media area).

Exine: ca. 2.2 micra, smooth; sexine (ca. 1.0 micra) as thick as nexine (ca. 1.1 micra).

Measurements.:

P/E = 1.28

Magnitudes	Range (micra)	$\frac{\bar{x} \pm s}{X}$ (micra)	s (micra)	V (%)
Polar diameter	32.4 - 40.4	36.2 \pm 0.4	2.2	6.1
Equatorial diameter	24.3 - 31.1	28.2 \pm 0.3	1.7	6.0

Neea theifera Oersted (BHM 1383)

(Figs. 7, 9, 12)

Oblate spheroidal in equatorial view, circular ambitus in polar view, 3-brevicolpate, reticulate grains.

Apertures: Three short and wide colpi (brevicolpi) without margo. Colpus length varying but in general much shorter than polar diameter. Polar area index magna.

Exine: thick; sexine as thick as nexine; sexine reticulate (meshes visible from 270X up); muri with irregular thickness forming irregular brocki.

Measurements.:

P/E = 0.95

P.A.I. = 0.55

Magnitudes	Range (micra)	$\frac{\bar{x} \pm s}{X}$ (micra)	s (micra)	V (%)
Polar diameter	25.4 - 31.4	28.2 \pm 0.3	1.6	5.8
Equatorial diameter (equatorial view)	28.1 - 31.8	29.5 \pm 0.3	1.3	4.3
Side of Apocolpium	12.9 - 20.5	16.2 \pm 0.4	2.2	13.6
Equatorial diameter (polar view)	27.0 - 31.7	29.6 \pm 0.3	1.6	5.5
Colpus length	7.9 - 22.5	13.2 \pm 0.9	4.3	32.7
Colpus breadth	2.8 - 5.0	4.0 \pm 0.1	0.5	13.2
Exine	2.6 - 3.1	2.9 \pm 0.03	0.2	5.9
Sexine	1.1 - 1.7	1.5 \pm 0.03	0.2	11.3
Nexine	1.1 - 1.9	1.6 \pm 0.04	0.2	12.5

Crumenaria polygaloides Reiss (SP 64969)

(Figs. 10 - 11)

Oblate spheroidal in equatorial view, triangular-shaped in polar view, 3-colporate, angulaperturate, psilate grains.

Apertures : three colpi ca. 26.0 micra long and ca. 3.2 micra wide (without margins); colpus provided with margo (ca. 1.3 micra wide) that at os region surrounds the os, keeping the same anterior width. Large lalongate os (ca. 4.8 micra long and ca. 7.8 micra wide) with round ends which are not always sharply visible. There is a light colored elliptical area that surrounds each aperture. Minuta polar area.

Exine : circa 2.0 micra thick; sexine (ca. 1.2 micra) as thick as nexine (1.0 micra); sexine smooth with a light colored granulation in oil immersion observation.

Measurements:

P/E = 0.99
P.A.I. = 0.20

Magnitudes	Range (micra)	$\bar{x} \pm \frac{s}{\sqrt{X}}$ (micra)	s (micra)	V (%)
Polar diameter	19.1 - 36.8	32.9 \pm 0.7	3.6	10.9
Equatorial diameter (equatorial view)	29.3 - 38.7	33.3 \pm 0.4	2.2	6.6
Side of apocolpium	4.3 - 8.7	6.5 \pm 0.2	1.1	16.8
Equatorial diameter (polar view)	28.6 - 34.8	31.7 \pm 0.3	1.8	5.5

Cestrum pedicellatum Sendl. (SP 20444)

(Figs. 13 - 15)

Sub-prolate in equatorial view, triangular to circular in polar view, 3-colporate finely striate grains.

Apertures : Three colpi surrounded by margo; margo (ca. 3.0 micra wide) elevated at os region. Large thin

lalongate os without margo and with sharp ends. Side of apocolpium ca. 8.3 micra; equatorial diameter in polar view ca. 39.1 micra; polar area index 0.21 (minuta area).

Exine : In polar view, at mesocolpium, exine is ca. 2.3 micra thick, sexine (ca. 1.5 micra) is thicker than nexine (ca. 0.9 micra). At the ora region the exine raises up (ca. 4.1 micra maximum thickness) by the presence of a third layer (ca. 2.6 micra maximum thickness) between sexine and nexine; the two later maintain the same thickness throughout this region. Sexine is more or less striate at oil immersion observation.

Measurements:

P/E = 1.20

Magnitudes	Range (micra)	$\bar{x} \pm \frac{s}{\sqrt{X}}$ (micra)	s (micra)	V (%)
Polar diameter	41.4 - 47.7	44.7 \pm 0.4	2.1	4.6
Equatorial diameter	35.0 - 39.6	37.0 \pm 0.3	1.3	3.6
Colporus length	30.0 - 45.3	37.0 \pm 0.8	4.1	11.2
Colporus width	3.3 - 6.6	5.2 \pm 0.1	0.7	13.5
Os length	2.9 - 4.9	4.0 \pm 0.1	0.6	13.9
Os width	15.8 - 27.7	21.1 \pm 0.5	2.7	12.9

Solanum grandiflorum Ruiz et Pav. (RB 83865)

(Figs. 16, 18, 19)

Oblate spheroidal in equatorial view, triangular-shaped in polar view, 3-colporate, psilate, grain. The specimen

from Belem (SP 58500) presents 92% of 3-colporate grains and 8% of 4-colporate grains (out of 400).

Apertures: three colpi surrounded by margo. Colpus ca. 3.9 micra wide; since ends of colpus are not sharply visible the length could not be measured. Margo protrudes at os region, forming a marked elevation (ca. 5.5 micra high). Large lalongate os with round ends (ca. 5.6 micra long and ca. 19.2 micra wide); os sometimes slightly constricted at the middle and always provided with margo. Minuta polar area.

Exine: in polar view, at mesocolpium, exine is ca. 2.4 micra thick, sexine is as thick as nexine (ca. 1.2 micra). At oral region sexine is thicker (ca. 1.7 micra) than nexine (ca. 1.4 micra), and a third layer appears between them increasing in thickness toward the os, up to 2.4 micra thick; exine total thickness comes up to 5.5 micra at oral region contrasting with exine at mesocolpium (ca. 2.4 micra). Sexine is smooth (granulate?) at oil immersion observation.

Measurements:

P/E = 0.86

P.A.I. = 0.18

Magnitudes	Range (micra)	$\frac{\bar{x} \pm s}{X}$ (micra)	s (micra)	V (%)
Polar diameter	23.6 - 32.7	28.4 \pm 0.6	3.0	10.6
Equatorial diameter (equatorial view)	28.6 - 37.8	33.1 \pm 0.6	3.2	9.7
Side of Apocolpium	3.5 - 9.2	6.1 \pm 0.3	1.3	21.3
Equatorial diameter (polar view)	30.7 - 37.8	34.1 \pm 0.3	1.8	5.3

Solanum lycocarpum St. Hil. (SP 25291)

(Fig. 17)

Grains similar to those of *Solanum grandiflorum* Ruiz et Pav.

Apertures: Colpus ca. 2.5 micra wide; since ends of colpus are not sharply visible the length could not be measured. Os margo ca. 3.0 micra thick. Minuta polar area.

Exine: In polar view, at mesocolpium, exine is ca. 2.6 micra thick, sexine (ca. 1.6 micra) thicker than nexine (ca. 1.0 micra). At the oral region the nexine stays as thick as the sexine (ca. 1.6 micra) and a third layer appears with maximum thickness ca. 2.2 micra thick; exine total thickness comes up to 5.5 micra at oral region contrasting with exine at mesocolpium (ca. 2.6 micra). Sexine is granulate (?) at oil immersion observation.

Measurements:

P/E = 0.89

P.A.I. = 0.16

Magnitudes	Range (micra)	$\frac{\bar{x} \pm s}{X}$ (micra)	s (micra)	V (%)
Polar diameter	21.7 - 31.1	25.1 \pm 0.4	1.7	6.8
Equatorial diameter (equatorial view)	25.5 - 30.0	28.1 \pm 0.2	1.0	3.6
Side of Apocolpium	3.3 - 6.7	4.4 \pm 0.1	0.8	18.1
Equatorial diameter (polar view)	25.0 - 28.7	27.0 \pm 0.2	1.0	3.7
Os length	2.5 - 4.5	3.6 \pm 0.1	0.4	11.4
Os breadth	9.6 - 14.6	12.2 \pm 0.3	1.3	10.6

Schwenckia americana L. var. *angustifolia* Schmidt
(HB 45975)
(Figs. 20 - 23)

Subprolate in equatorial view, circular slightly lobate ambitus in polar view, 3-colporate, reticulate grains.

Apertures: three colpi (ca. 13.5 micra long and ca. 3.2 micra wide with margo) surrounded by margo; colporus located in a depression. Large lalongate os not always visible in the our preparation (ca. 4.6 micra long and 11.8 micra wide).

Side of apocolpium ca. 3.8 micra; equatorial diameter in polar view ca. 23.3 micra (out of 17 grains); polar area index 0.16 (minuta area).

Exine: ca. 1.6 micra thick; sexine as thick as nexine (ca. 0.8 micra); sexine reticulate, meshes visible from 600x up.

Measurements:

$$P/E = 1.67$$

Magnitudes	Range (micra)	$\bar{x} \pm \frac{s}{\sqrt{X}}$ (micra)	s (micra)	V (%)
Polar diameter	16.7 - 22.8	20.4 \pm 0.2	1.2	5.9
Equatorial diameter (equatorial view)	21.8 - 26.2	23.8 \pm 0.2	1.2	5.0

DISCUSSION

The pollen grains of *Diospyros inconstans* differ from those of *D. hispida* by their shape (subprolate; prolate), by their type of colporus, and by their size. Polar diameter in *D. inconstans* has confidence interval from 35.3 micra to 37.1 micra at 95% level, while in *D. hispida* has from 45.1

micra to 46.7 micra; equatorial diameter of *D. inconstans* has confidence interval from 27.6 micra to 28.8 micra, while *D. hispida* has from 31.4 micra to 33.8 micra (95% level). Therefore polar and equatorial diameters of *D. hispida* are significantly larger than the diameters of *D. inconstans*.

The three genera of Solanaceae studied have 3-colporate pollen grains with minuta polar area and lalongate os. But each genus differs from the others by size and details of the apertures.

1. *Cestrum* is subprolate, polar diameter averaging 47.7 micra, colporus with thin sharp end os, presence of elevation at os region, finally striate sexine.

2. *Solanum* is oblate spheroidal, polar diameter averaging 23-25 micra, colporus with round end marginate os, presence of elevation at os region, psilate (granulate ?) sexine.

3. *Schwenckia* is subprolate, polar diameter averaging 20.4 micra, colporus with round end os, elevation at os region absent, reticulate sexine.

Neea theifera was the only species of Nyctaginaceae studied here, for the other genus represented in the Cerrado flora [*Pisonia* (Plum.) L.] have very delicate grains; they are wrinkled even in the herbarium specimens. The same can be said of pollen from *Diospyros sericea* A. DC.

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SUMÁRIO

Neste trabalho foram estudados os grãos de pólen de : *Diospyros inconstans* Jacq., *D. hispida* A. DC., *Neea theifera* Oersted, *Crumenaria polygaloides* Reiss, *Cestrum pedicellatum* Sendl., *Solanum grandiflorum* Ruiz et Pav., *S. lycocarpum* St. Hil., *Schwenckia americana* L. var. *angustifolia* Schmidt.

As duas espécies de *Diospyros* podem ser separadas facilmente. As Solonáceas apresentam características bem distintas quanto ao pólen dos três gêneros estudados, permitindo separá-los uns dos outros.

BIBLIOGRAPHY CITED

FERRI, M. G.

1955 — Contribuição ao conhecimento da ecologia do Cerrado e da Caatinga. *Bol. Fac. Fil. Ci. Letras Univ. São Paulo*, 196 (Bot. 12) : 1-170, 100 fig. 18 tab.

RIZZINI, C. T.

1963 — "A flora do Cerrado". In : SIMPÓSIO sobre o Cerrado. São Paulo, Ed. Universidade. 423 p. p. 125-69.

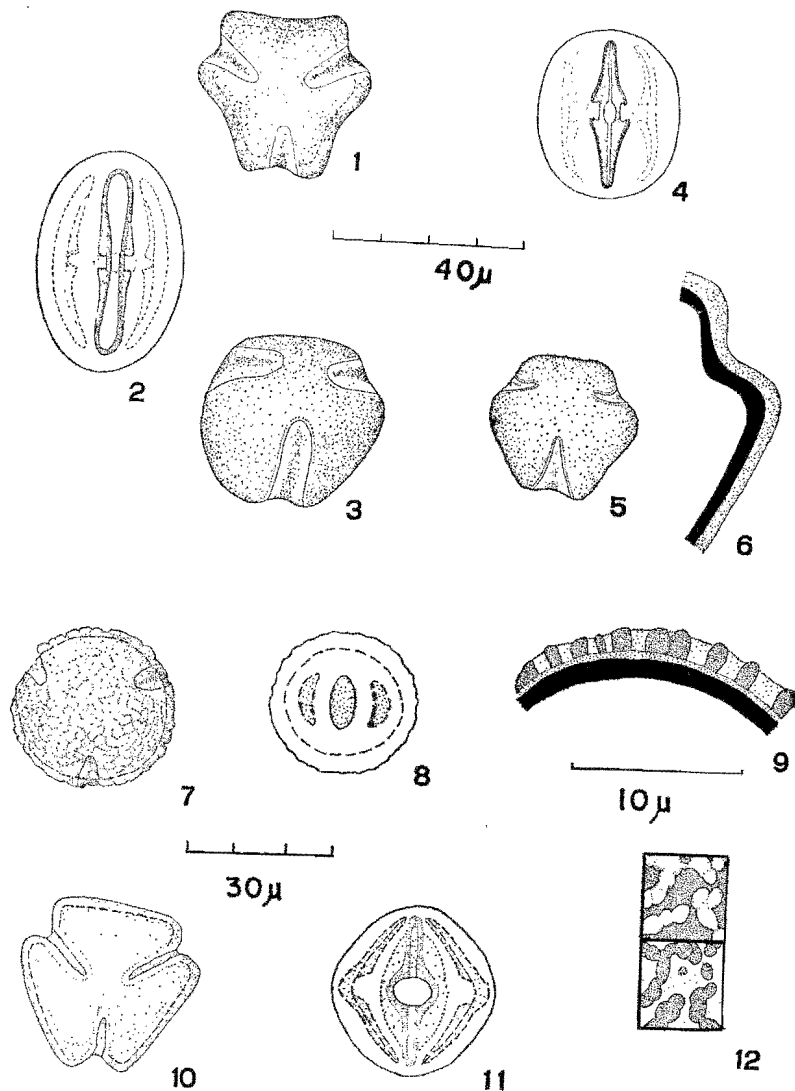
SALGADO-LABOURIAU, M. L.

1966 — Palinologia dos Cerrados. *An. Ac. Bras. Ci.* Rio de Janeiro, 38 supl. : 187-205. 23 fig. 4 tab.

WARMING, E.

1909 — *Lagoa Santa : contribuição para a geographia phytobiologica*. Trad. A. Loefgren. Belo Horizonte, Imp. Oficial. 282 p. il.

ENTREGUE PARA PUBLICAÇÃO EM 3/7/68

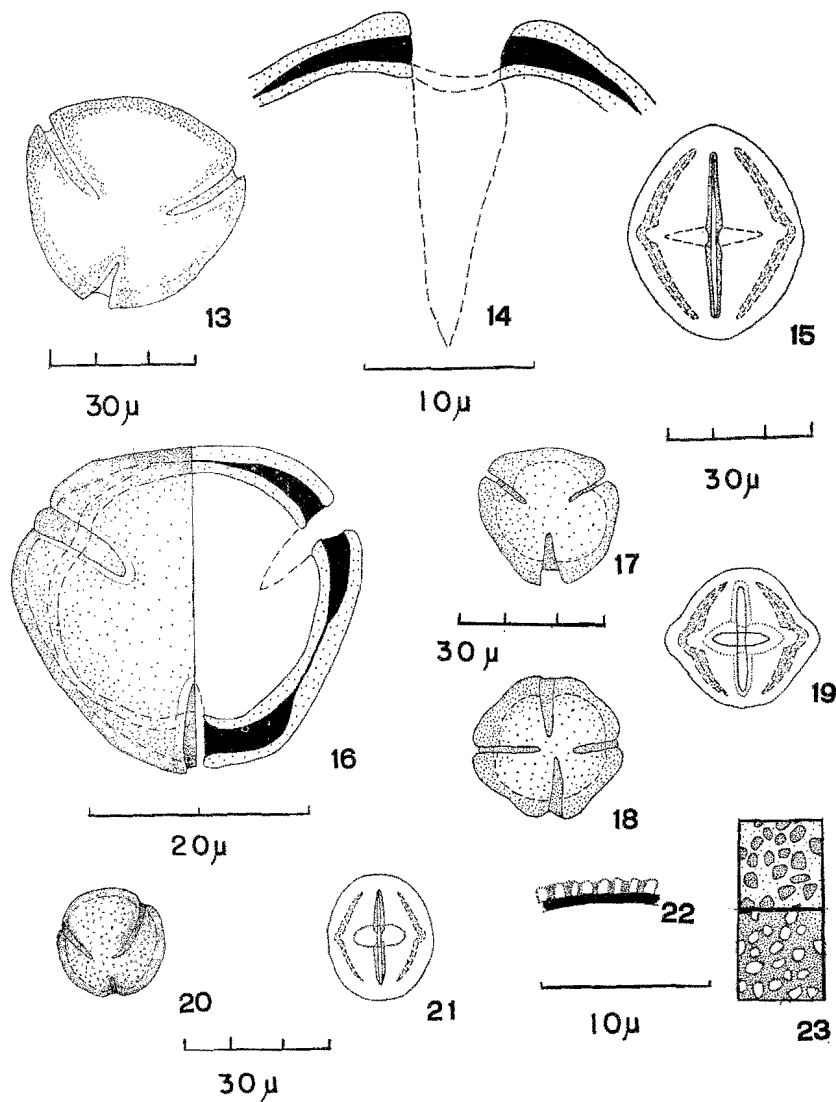


Diospyros hispida A. DC.: fig. 1 — schematic representation of the grain in equatorial view; fig. 2 — whole grain in polar view; fig. 3 — whole grain showing the extreme form of triangular ambitus which is rare.

Diospyros inconstans Jac.: fig. 4 — whole grain at polar view; fig. 5 — schematic representation of grain in equatorial view; fig. 6 — optical section.

Neea theifera Oersted : fig. 7 — whole grain in polar view; fig. 8 — schematic representation in equatorial view; fig. 9 — optical section of exine; fig. 12 — LO — analysis of exine.

Crumenaria polygaloides Reiss : fig. 10 — whole grain in polar view; fig. 11 — schematic representation of grain in equatorial view.



Cestrum pedicellatum Sendl.: fig. 13 — whole grain in polar view; fig. 14 — optical section of exine at apertural region; fig. 15 — schematic representation of grain in equatorial view.

Solanum grandiflora Ruiz et Pav.: fig. 16 — grain in polar view showing surface and optical section; fig. 18 — 4-colporate grain; fig. 19 — schematic representation of grains in equatorial view.

Solanum lycocarpum St. Hil.: fig. 17 — whole grains in polar view.

Schwenckia americana L. var. *angustifolia* Schmidt: fig. 20 — whole grain in polar view; fig. 21 — schematic representation in equatorial view; fig. 22 — optical section of exine; fig. 23 — LO-analysis of exine.