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POLLEN MORPHOLOGY OF IBERIAN SPECIES OF LAVANDULA L. FUNCTIONAL AND TAXONOMIC SIGNIFICANCE

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SUMMARY. A light microscopy, scanning electron microscopy and transmission electron microscopy study of the pollen grains of some Iberian species of the genus **Lavandula** L. was carried out. The sections proposed by SUAREZ-CERVERA & SEOANE-CAMBA (1986c), are confirmed from the palynological point of view, and a hypothesis on the possible evolution of the studied taxa is presented, according to their chromosome numbers and exine morphology. We point out the relationship existing between the strúcture of the exine and harmomegathic movements, and also the possible significance of the pollen coat in pollination.

RESUMEN. Se hace un estudio a microscopía óptica, electrónica de barrido y electrónica de transmisión de algunas especies ibéricas del gen. **Lavandula** L. Desde el punto de vista palinológico se confirman las secciones propuestas por SUAREZ-CERVERA & SEOANE-CAMBA (1986c) y se expone una hipótesis sobre la posible evolución de los taxa estudiados, de acuerdo con los números cromosomáticos y la morfología de la exina. Se pone de manifiesto la relación existente entre la estructura de la exina y los movimientos harmomégatas, así como la posible importancia del "pollen coat" en la polinización.

INTRODUCTION

Lavandula L. is a type of the Lamiaceae family created by LINNE (1753); since then several authors have studied it, CAVANILLES (1802), GINGINS DE LASSARAZ (1826), BENTHAM (1833,1848), BRIQUET (1895). More recently CHAYTOR (1937) made a thorough monography, ROZEIRA (1949, 1964) studied principally the Portuguese taxa and SUAREZ-CERVERA (1985) reviewed the Iberian species.

Today the genera includes 28 species with a distribution that goes from the Island of Cape Green in the Azores, to India (from Bombay to Bengal), through the Canary Islands, North Africa, the Mediterranean region and southern Arabia (CHAYTOR 1937). In Europe GUINEA (1972) mentions 6 species and 8 subspecies, 11 of which are represented in the Iberian Peninsula, with some taxa being exclusively Iberian.

Palynologically it has been studied by several authors BARBIER (1963), NABLI (1976), ROCA (1978), ROMERO & PARDO (1983), SUAREZ-CERVERA (1985), SUAREZ-CERVERA & SEOANE-CAMBA (1983, 1985, 1986a, 1986b).

In this work we inform on the results of a study at L.M., S.E.M. and T.E.M. of the pollen grains of some Iberian species and their possible functional and taxonomic significance.

MATERIALS AND METHODS

ERDTMAN (1960) acetolysis was used for the light microscopic study, with REITSMA (1969) modifications, setting the temperature at 70ºC and the acetolysis time at 5 minutes, owing to the exine fragility of the pollen grains of this type. Mounting was made in polyvynilic alcohol and Eukitt synthetic resin. Studies were made using a Nikkon Optiphot microscope. A total of 189 populations was examined, the list of which is given in Appendix; we have considered the grains extracted from a spike as a pollinical population; a measurement was taken of each one of their polar axis (P), equatorial diametre in meridian optical section (Ecm); relation P/E and equatorial diametre in meridian optical section (Ece); obtaining the average, the comparison of the frequency averages was made by Simpson & Roe test (PLUYN & HIDEUX 1977). First the test was made for all the populations of each taxon and, afterwards, a general test was made with the average of the data of all the populations studied, eliminating those that presented bimodal curves and which could produce a significant alteration.

For SEM the material acetolysed was dehydrated in alcohol and coated with gold for seven minutes. We used a Stereoscan Cambridge Instruments for observations. At TEM we have always worked with non-acetolysed material. The pollen grains, previously included in agar at 2%, or the anthers, were fixed with glutaraldehyde at 3.5% in Na-cacodylate buffered (0.25 M) at 4 ºC, the post-fixing was made in osmium tetroxide at 1% also buffered, dehydration was the carried out in the series of alcohols and was included in Araldite. The thin sections were contrasted with lead citrate and uranyl acetate according to REYNOLDS (1963). The observations were made with a Philips OM2. The terminology used was that of ERDTMAN (1969), PRAGLOWSKI (1971), FAEGRI & IVERSEN (1975), APLF (1975), NILSSON & MULLER (1978) and SAENZ (1978).

RESULTS

General description of pollen

L.M. (Figs. 1,2), SEM (Figs. 1,2,3). Pollen grains 6-colpate, isopolar, of subcircular to hexagonal shape in equatorial optical section, with 6 subterminal colpi. Subprolate, spheroidal-prolate or prolate, that oscillates from subrectangular to oval in meridian optical section. Simple apertures, with ornamented or simply perforated margins. Dimensions between P 41.13 - 27.33 µm; Ecm 34.36 - 21.7 µm; Ece 41.43 - 25.56 µm. The exine has a complet tectum which goes from microperforate to perforate, and a partial tectum foveolate or reticulate. The colpal membrane is rugose, sometimes granular, with fine and dispersed perforations. TEM (Figs. 3,4,5). The exine is made up of a more or less

wide ectexine, with perforate or reticulate tectum, smooth or slightly ondulated; the infratectum is columellar, with columellae relatively straight and regular. The foot layer of the mesocolpium may be wide, thin without perforations, thin with perforations or clearly interrupted; it may also present transversal channels which generally coincide with the extension of the axis of the columellae; in the area near the apertures the foot layer narrows until it disappears and the tectum and columelles lessen in size. In the centre of the aperture, the ectexine no longer exists and the endexine, in direct contact with the exterior presents a rugate surface, sometimes finely perforated. In the intercolpal zones, the endexine is slim, made up a fine perforated coat with some granulations and residues of lamella. The pollen coat is abundant in all species, both in the intercolumellar zone as coating the exine; this substance at times presents a different osmiophility depending on the taxa. In the columellar zone we observe a fibrillar material which, in our opinion (SUAREZ-CERVERA & SEOANE CAMBA 1986a) could be residues of the proexinic or glycocalyx matrix (ROWLEY 1973). The intine is typically made up of cellulose threads, with two or three layers being observed at times.

The pollen morphological data based on LM, SEM and TEM investigation are recorded in Tables 1 and 2.

DISCUSSION AND CONCLUSIONS

The pollen of this genus is characterized by having a very fragile exine in all the taxa studied (with the exception of **L. multifida** L.) which easy breaks in the acetolytic process. In our opinion this fact might be due to two factors: a) a chemical factor, due to a smaller quantity of sporopollenine deposited in the exine; and b) a physical factor, due to the absence of foot layer in certain zones or its thinning in others; this latter would explain the exaggerated fragility observed in the pollen of **L. dendata** L., which has a foot layer with several interruptions (SUAREZ-CERVERA & SEOANE-CAMBA 1986b).

With the data in this work we show that the absence of the foot layer near the apertural zones observed in **L. viridis** L'Her. (SUAREZ-CERVERA & SEOANE-CAMBA 1985), **L. pedunculata** Cav. and **L. multifida** L. (SUAREZ-CERVERA & SEOANE-CAMBA 1983), is maintained in all Iberian species and subspecies. This phenomenon, which appears to be common to other Lamiaceae (NABLI 1976), is, we believe, related with the harmomegatic movements. To explain this fact we set ourselves an apertural model for **L. viridis** L'Her. (SUAREZ-CERVERA & SEOANE-CAMBA 1985) which we consider correct to generalize to all the other taxa studied.

The distinct osmiophility observed in the pollen coat of taxa belonging to different sections, such as **L. latifolia** Medicus (Fig. 5C) and **L. stoechas** L. subsp. **sampaina** Rozeira (Fig. 4A, B) would confirm the hypothesis put forward by other authors (DUMAS & GAUDE 1981, HESSE 1981, ZANDONELLA, DUMAS & GAUDE 1981, KNOX 1984) on the importance of the pollen coat in the pollination phenomena, fundamentally in the pollen-stigma recognition, since natural hybrids between both species are unknown.

Of the statistic study of the measurements P, Ecm, P/E and Ece (Fig.6) we can establish three groups with respect to dimensions: Group A, section **Stoechas**; Group B, sections **Lavandula** and **Dentata**; Group C, **L. multifida** L. (the only Iberian representative of the **Pterostoechas**

section). However we can separate four clear pollen types if we use all the characters observed at LM, SEM and TEM. (Tables 1,2,3).

TYPE I - **L. multifida** L.: Microperforated pollen (<0.1 um); ornamented margin; branched columellae; P 41.13 µm; Ecm 34.36 µm; exine 2.26 µm.

TYPE II - **Stoechas** section: Perforate pollen (0.1-0.5 µm); P 27.33 - 29.21 µm; Ecm 21.7 - 22.87 µm; exine 0.72 - 1.2 µm.

TYPE III - **Lavandula** section: Foveolate pollen (0.9 - 1.5 µm); P 32.46 - 36.72 µm; Ecm 24.74 - 27.05 µm; exine 1.6 - 1.8 µm.

TYPE IV - **Dentata** section: Reticulate pollen (2 µm); P 35 um; Ecm 24.9 µm; exine 0.80 µm.

These four pollen types confirm the three sections established by GINGINS DE LASSARAZ (1926) and the **Dentata** section, proposed by SUAREZ-CERVERA & SEOANE-CAMBA (1986c) for the Iberian taxa of **Lavandula** L.

L. multifida L., with a distribution restricted to low levels of the southeastern part of the Iberian peninsula, near the coast (SUAREZ-CERVERA & SEOANE-CAMBA 1986d), substantially differs from the rest of Iberian **Lavandula** L., but presents a great coincidence with the other macaronesic taxa of the **Pterostoechas** section (ROCA 1978).

Finally the comparison of the chromosome numbers the Iberian species of **Lavandula** L. (SUAREZ-CERVERA 1986) with pollen morphology, allows us to establish an hypothesis in relation with the possible evolution of these taxa. In our opinion that **L. multifida** L. would be the most primitive representative (2n = 24 and microperforate exine), followed by the **Stoechas** section (2n = 30 and perforate exine), the **Lavandula** section (2n = 36, 48, 50, 54 and foveolate exine) and **Dentata** section (2n = 42, 45 and reticulate exine). This order just agree with the evolution of exine proposed by WALKER (1974).

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SPECIES EXAMINED

(country, province, UTM and reference of Herbarium).

L. angustifolia Miller subsp. **pyrenaica** (DC.) Guinea. ESPAÑA. BARCELONA: Sierra del Cadí, CG88, BCF32553. GERONA: Alp, DG09, BCF32746; La Molina, DG09, BCF32747. HUESCA: Puerto de Santa Bárbara, XN71, BCF32018; Valle de Ansó, Biniés, XN72, BCF32561; San Juan de la Peña, XN80, BCF32562; Valle de Hecho, Embun, XN88, BCF32564; Acín de Garcipollera, XN91, BCF32565, BCF32566. LERIDA: Banys de Sant Vicent, CG99, BCF32555; Espot, CH22, BCF32556, BCF32557; Puerto de la Bonaigua, CH32, BCF32558; Rialp, CH50, BCF32559, BCF32560; Coll Montllober, CG17, BCF32551.

L. latifolia Medicus. ESPAÑA. ALICANTE: Sierra Aitana, Guadalest, YH48, BCF32749. CUENCA: Saelices, Tarancón, VK83, BCF32492. GERONA: Campdevanol, Pardinellas, DG27, BCF32491. HUESCA: Ayerbe, XM98, BCF32495; Valle del Roncal, Sigués, XN62, BCF32496; Puerto de Santa Bárbara, XN71, BCF32497; Valle de Ansó, Biniés, XN72, BCF32498, BCF32499; Valle de Hecho, Embun, XN88, BCF32500; Acín de Garcipollera, XN91, BCF32507. SORIA: Km 178 CN-122, WM22, BCF32020. TARRAGONA: Sierra de Prades, Alcober, CF26, BCF32748.

L. Lanata Boiss. ESPAÑA. ALMERIA: Sierra de Gador, WF28, BCF32504. GRANADA: Sierra Guajaras, VF38, GDAC6243; Sierra Nevada, carretera al Veleta, VG70, BCF32745; idem. Canales, VG70, GDAC1178; idem. Dornajo, VG71, GDAC1176, GDAC1180; idem. Hotel Santa Cruz, VG71, GDAC1177.

L. stoechas L. subsp. **stoechas**. ESPAÑA. ALMERIA: Fuengirola, UF54, MCG3355; Lanjar, WF19, GDAC10669; Mojacar, XG01, BCF32509. BARCELONA: Caldas de Montbui, DG11, BCF32027; Mas Badó, DG22, BCF32754; Sant Antoni de Vilamajor, DG41, BCF32755; Tordera, DG71, BCF32507. CADIZ: Punta las Palomas, TE29, GDAC2330, GDAC2257. GRANADA: Cabo Sacratif, VF56, GDAC5309; Costa de Granada, VF66, GDAC1186. MALAGA: de Estepona a Peñas Blancas, UF03, MGC3568; Estepona, UF13, MGC3547; Serranía de Ronda, La Nava, UF16, MGC2912; Torrox, VF16, MGC3728; Frigiliana, VF26, MGC8656. PONTEVEDRA: La Guardia, playa de Camposancos, NG13, BCF32508. TARRAGONA: Coll d'Alforja, CF26, BCF32750; Santuari de Puigcerver, CF26, BCF32751; Aleixar, CF26, BCF32752; Vilaplana, CF26, BCF32753.

L. stoechas L. subsp. **lusitanica** (Chaytor) Rozeira. ESPAÑA. HUELVA: cercanías de Punta Umbría, PB81, GDAC4371; Rocío y Matalascañas, QB22, SEV4361; Hinojos, QB33, SEV9569. SEVILLA: Cantillane, TG26, SEV81052. PORTUGAL. BAIXO ALENTEJO: Dunas, NC22, SEV8592; Dunas e Lagoa de Melides, NC22, SEV8821.

L. stoechas L. subsp. **luisieri** (Rozeira) Rozeira. PORTUGAL. ALGARVE: Monchique, NB33, BCF32519; San Lois, BN32, BCF32520. ALTO ALENTEJO: entre Altaho y Vendas Novas, NC48, BCF32523; Vendas Novas, NC48, BCF32524.

L. stoechas L. subsp. **sampaiana** Rozeira. ESPAÑA. LEON: Ponferrada, Borrenes, PH80, BCF32538. ORENSE: Centellaes, PG48, BCF32534; Central de Zevereño, PG49, BCF32535; Alto de Covelo, PG57, BCF32536; Central de Cornatell, PG59, BCF32537. SALAMANCA: Ciudad Rodrigo, QE09, BCF32539; Villarino de los Aires, QF17, BCF32540. PORTUGAL. ALTO ALENTEJO: Vendas Novas, NC48,

BCF32526. BEIRA ALTA: Seia, PE17, BCF32528; Km 328 carretera a Ciudad Rodrigo, PE99, BCF32529; Barca d'Alba, PF74, BCF32532. TRAS OS MONTES E ALTO DOURO: de Moncorvo a Frescoa, PF66, BCF32530; Cervicais, PF66, BCF32531; Freixo de Espada a Cinta, PF85, BCF32757.

L. pedunculata Cav. ESPAÑA. CACERES: Navalmoral de la Mata, TK82, BCF32513. MADRID: Alcorcón, VK17, BCF32514. SALAMANCA: km 301 CN a Ciudad Rodrigo, QF42, BCF32511. SORIA: entre Carboneras y Villacieros, WM21, BCF32515; Carboneras, WM32, BCF32516. TARRAGONA: Prades, CF37, BCF32756; Sierra de Prades, Alcober, CF37, BCF32510. ZAMORA: Benavente, Rio Negro de Puente , QG35, BCF32512.

L. dentata L. ESPAÑA. ALICANTE: Peñón de Ifac, BC48, BCF32016. ALMERIA: Mojacar, XG01, BCF32062.

L. multifida L. ESPAÑA. ALMERIA: Mojacar, XG01, BCF32063; de Puerto Lumbreras a Aguilas, XG25, BCF32548. MALAGA: Sierra de Mijas, Mijas, UF55, MGC9762; Alhaurín de la Torre, UF65, MGC9763; Venta del Tunel, UF86, MGC9764; Cala del Moral, El Cantal, UF85, MGC1359; Banagalbón, UF86, MGC2010; Montes de Gibralfaro, UF87, MGC9765; Cerro de San Antón, UF87, MGC2092. PORTUGAL. ESTREMADURA: Sierra de Arrabida, MC95, MA99845.

TAXA	SHAPE	P	Ecm	P/E	Ece	APERTURES			EXINE		
						Colpi	Margin	Colpal Membrane	Type	Lumen	Muri
Section Lavandula											
L. angustifolia subsp. pyrenaica	SP,OSR	32.46 (28.37-34.71)	24.74 (23.97-26.51)	1.31 (1.19-1.41)	30.92 (29.22-33.00)	AS	P	RP	FO	C-0.90	P
L. latifolia	SP,OSR	33.36 (30.19-35.66)	26.05 (25.36-27.22)	1.26 (1.15-1.34)	32.86 (31.22-35.68)	AS	P	RP	FO	C-1.40	P
L. lanata	PR,OE	36.72 (36.27-38.71)	27.05 (26.80-27.34)	1.35 (1.33-1.43)	37.54 (35.82-38.97)	AS	P	RP	FO	PL-1.25	CO
Section Stoechas											
L. stoechas subsp. stoechas	SP,SR	27.50 (25.37-30.10)	22.11 (20.77-24.43)	1.23 (1.14-1.29)	29.57 (26.68-34.05)	AS	P	RP	P	0.2-0.5	-
L. stoechas subsp. lusitanica	SP,SR	29.21 (26.55-31.94)	22.33 (20.34-24.44)	1.30 (1.28-1.32)	31.20 (27.30-33.32)	AS	P	RP	P	0.2-0.5	-
L. stoechas subsp. luisieri	SP,SR	27.35 (25.87-28.57)	22.87 (21.39-25.25)	1.19 (1.04-1.31)	30.44 (28.02-35.19)	AS	P	RP	P	0.2-0.5	-
L. stoechas subsp. sampaiana	SP,SR	27.33 (25.66-29.01)	21.70 (20.41-23.21)	1.25 (1.21-1.29)	29.58 (25.56-33.76)	AS	U	RP	P	0.1-0.2	-
L. pedunculata	SP,SR	27.91 (26.70-28.98)	21.72 (21.00-22.95)	1.28 (1.22-1.32)	30.07 (28.93-33.66)	AS	U	RP	P	0.1-0.2	-
L. viridis *	SP,SR	28.64 (22.70-34.15)	23.06 (17.50-28.98)	1.23 (0.91-1.91)	33.00 (22.77-41.40)	AS	P	RP	P	0.2-0.5	-
Section Dentata											
L. dentata	PR,OSR	35.00 (33.28-37.10)	24.90 (24.21-25.37)	1.37 (1.35-1.40)	36.09 (33.53-37.50)	AI	U	RP	RR	IR 2	PF
Section Pterostoeches											
L. multifida	SP,SR	41.13 (38.44-43.81)	34.36 (28.98-38.55)	1.19 (1.12-1.33)	41.43 (37.74-46.27)	OS	OR	-	MP	<0.1	-

TABLE 1.- Pollen morphological date based on light and scanning microscopic investigation (P, polar axis; Ecm, equatorial diametre in meridian optical section; Ece, equatorial diametre in equatorial optical section; PR, prolate; SP, subprolate; OSR, oval-subrectangular; OE, oval-elliptic; SR, subrectangular; AS, acute subterminal; AI, acute terminal; OS, obtuse subterminal; P, perforated; U, uneven; OR, ornamented ; RP, rugose perforate; FO, foveolate; RR, reticulate rugulate; MP, microperforate; C, circular; PL, poligonal; IR, irregular; CO, complete; PF, perforate foveolate. The measurements are in micrometres).
* SUAREZ-CERVERA & SEOANE-CAMBA (1985).

TAXA	EXINE	ECTEXINE	ENDEXINE	TECTUM	COLUNELLAE			FOOT LAYER		INTINE	POLLEN COAT
					height	thickness	distance	thickness	channels		
Section Lavandula											
L. angustifolia subsp. pyrenaica	1.60	1.57	0.03	0.33	1	0.24	0.27	- 0.22	1	-	-
L. latifolia	1.70	1.60	0.03	0.25	1	0.27	0.20	- 0.20	1	0.20	D
L. lanata	1.80	1.70	0.08	0.40	1	0.24	0.20	- 0.30	1	-	T
Section Stoechas											
L. stoechas subsp. stoechas	0.72	0.71	0.01	0.15	0.51	0.20	0.26	+ 0.07	0	0.35	M
L. stoechas subsp. luisieri	0.95	0.94	0.01	0.19	0.58	0.19	0.19	+ 0.15	0	0.31	M
L. stoechas subsp. sampaiana	0.98	0.96	0.01	0.23	0.66	0.23	0.14	+ 0.16	0	0.42	M
L. pedunculata **	0.91	0.80	0.01	0.20	0.49	0.14	0.19	+ 0.10	1	0.32	M
L. viridis *	1.27	1.18	0.08	0.24	0.76	0.26	0.31	+ 0.18	1	0.43	M
Section Dentata											
L. dentata	0.81	0.79	0.02	0.16	0.54	0.19	0.14	++ 0.07	0	0.28	D
Section Pterostoechas											
L. multifida **	2.26	2.22	0.06	0.27	1.06	0.25	0.21	- 0.38	0	0.20	T

TABLE 2.- Pollen morphological data based on transmission electron microscopic investigation. (-, without perforations; +, perforated; ++, interrupted; 1, present; 0, absent; M, medium; D, electrodense; T, transparent).
* SUAREZ-CERVERA & SEOANE-CAMBA (1985); ** SUAREZ-CERVERA & SEOANE-CAMBA (1983).

LEGENDES OF FIGURES

FIGURE 1.- (A,E,F,G,H) **L. angustifolia** Miller subsp. **pyrenaica** (DC.) Guinea. (B,C,I,J) **L. latifolia** Medicus. (D,K) **L. lanata** Boiss. (a) Apertural margin with perforations and foveolate exine. SEM X6200. (B) Verrucate and perforate (point arrow) apertural membrane. SEM X11400. (C) Apertural margin perforate and foveolate exine. SEM X7100. (D) Foveolate exine. SEM X6200. (E,F) Whole grain, acute subterminal colpi. SEM X1600. Scale line = 10 μm. (G-K) optical cross section. LM X700.

FIGURE 2.- (A-C) **L. stoechas** L. subsp. **stoechas**. (D,H-M) **L. stoechas** L. subsp. **sampaiana** Rozeira. (E) **L. stoechas** L. subsp. **lusitanica** (Chaytor) Rozeira. (F,G) **L. dentata** L. (A) Diffused margin and perforated rugose colpal membrane (arrow). SEM X5600. (B) Equatorial view, perforate exine. SEM X2800. (C) Subterminal colpi and diffused margin. SEM X2800. (D) 6-colpate in polar vision. SEM X2500. (E) Polar and equatorial vision, subrectangular outline. SEM X1000. Scale line = 10 μm. (F) Reticulate, irregular lumens. SEM X11300. (G) Equatorial vision, oval-subrectangular outline, terminal colpi. SEM X1254. Scale line = 10 μm. (H,M) Optical cross-section. LM X700.

FIGURE 3.- (A-B) **L. multifida** L. (C) **L. stoechas** L. subsp. **stoechas**. (D) **L. angustifolia** Miller subsp. **pyrenaica** (DC.) Guinea. (A) Optical vision, 6-colpate with ornamentated margin. LM X700. (B) Exine microperforate, ornamentated margin. SEM X7200. (C) Nonapertural wall; tectate columellate ectexine, thin and perforated food layer (arrow); thin endexine (double arrow) with perforations (point arrow); well developed intine (i); pollen coat (pc) deposed on exine and intercolumellae zone, note lamellate pollen coat (triple arrow). TEM X53800. (D) Nonapertural wall; intine (i); tectate-columellate ectexine; endexine with lamelle (arrow) and granulations; residues of the glycocalyx (gl.) TEM X51500.

FIGURE 4.- (A-B) **L. stoechas** L. subsp. **sampaiana** Rozeira. (A) Nonapertural wall; well developed intine (i); Thin homogeneous endexine; tectate-columellate ectexine, with perforated foot layer (arrow); very transparent pollen coat (pc), lamellate (double arrow); residues of the glycocalyx (gl). TEM X67200. (B) Cross section mesocolpium; note foot layer disappear in the periapertural wall (arrow); very transparent pollen coat (pc). TEM X13800.

FIGURE 5.- (A) **L. lanata** Boiss. (B) **L. stoechas** L. subsp. **luisieri** (Rozeira) Rozeira. (C) **L. latifolia** Medicus. (A) Apertural wall; intine (i); lax, lamellate and granulous endexine (arrow); note the tectum in direct contact with the endexine. TEM X45000. (B) Apertural wall; layered intine (arrow); foot layer absent (double arrow); pollen coat of moderate electrodensity (pc). TEM X45000. (C) Apertural wall; well structured intine (i); lax and granulous endexine (long arrow); foot layer absent (black and white arrow); very electrodense pollen-coat (pc). TEM X32500.

FIGURE 6.- Comparison of the averages of P, Ecm, P/E, Ece, by Simpson & Roe test. (pyr) **L. angustifolia** Miller subsp. **pyrenaica** (DC.) Guinea; (lat) **L. latifolia** Medicus; (lan) **L. lanata** Boiss.; (sto) **L. stoechas** L. subsp. **stoechas**; (ped) **L. pedunculata** Cav.; (lus) **L. stoechas** L. subsp. **lusitanica** (Chaytor) Rozeira; (lui) **L. stoechas** L. subsp. **luisieri** (Rozeira) Rozeira; (samp) **L. stoechas** L. subsp. **sampaiana** Rozeira; (vir) **L. viridis** L'Her; (den) **L. dendata** L.; (mul) **L. multifida** L.; (1) section **Lavandula**; (2) section **Stoechas**; (3) section **Dentata**; (4) section **Pterostoechas**. (Averages of **L. viridis** L'Her originals from Suarez-Cervera & Seoane-Camba 1985).

FIGURE I

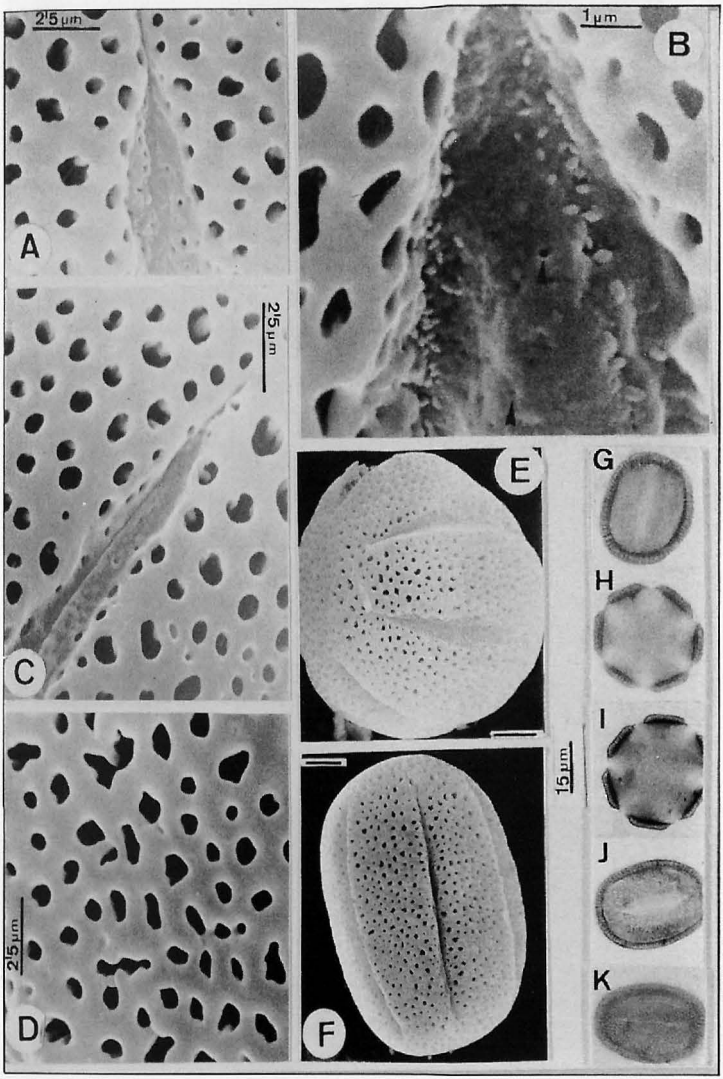


FIGURE II

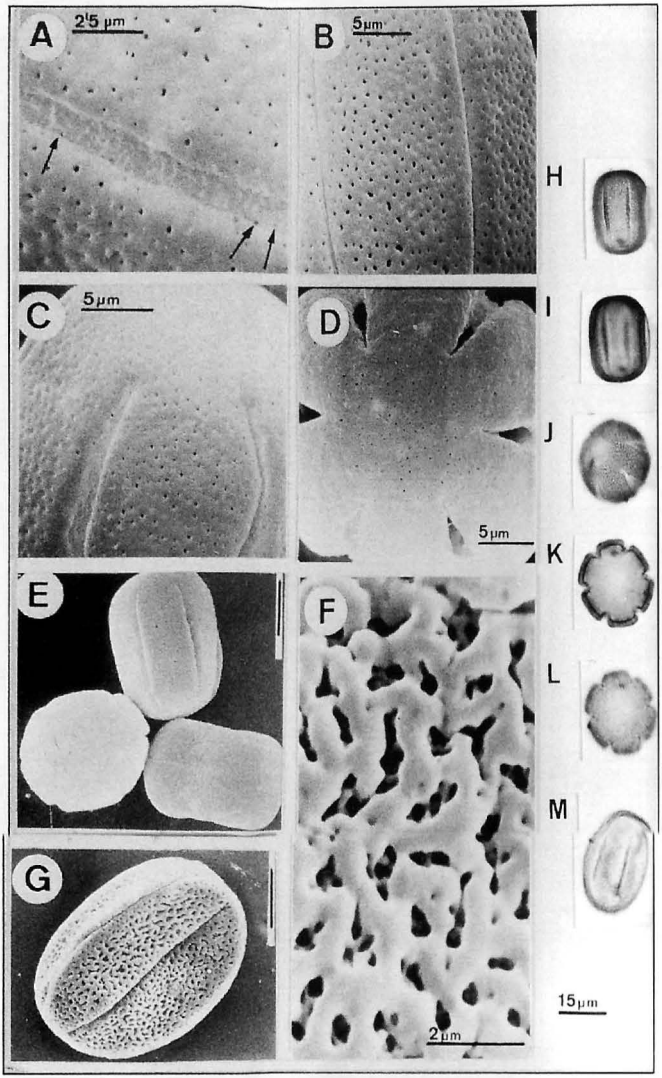


FIGURE III

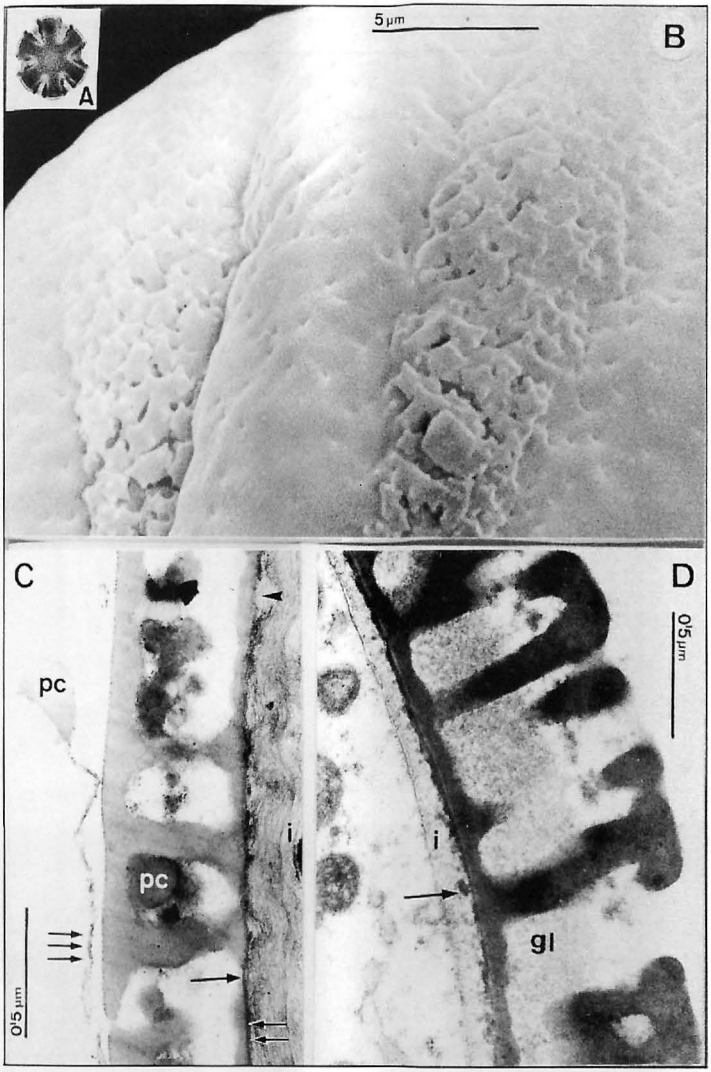


FIGURE IV

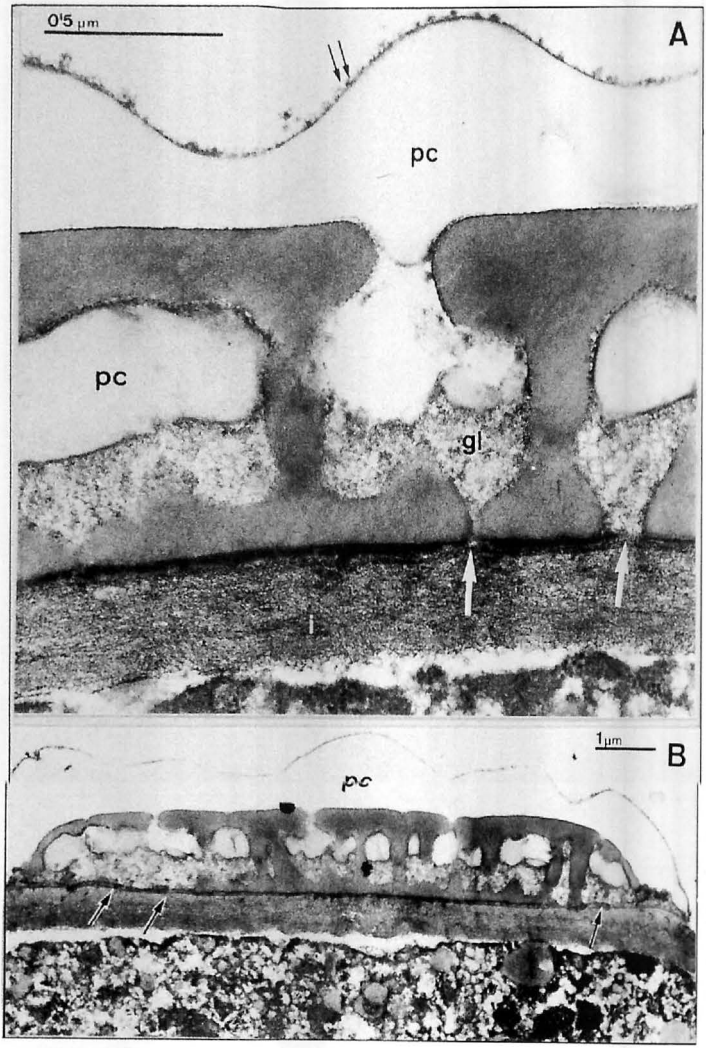


FIGURE V

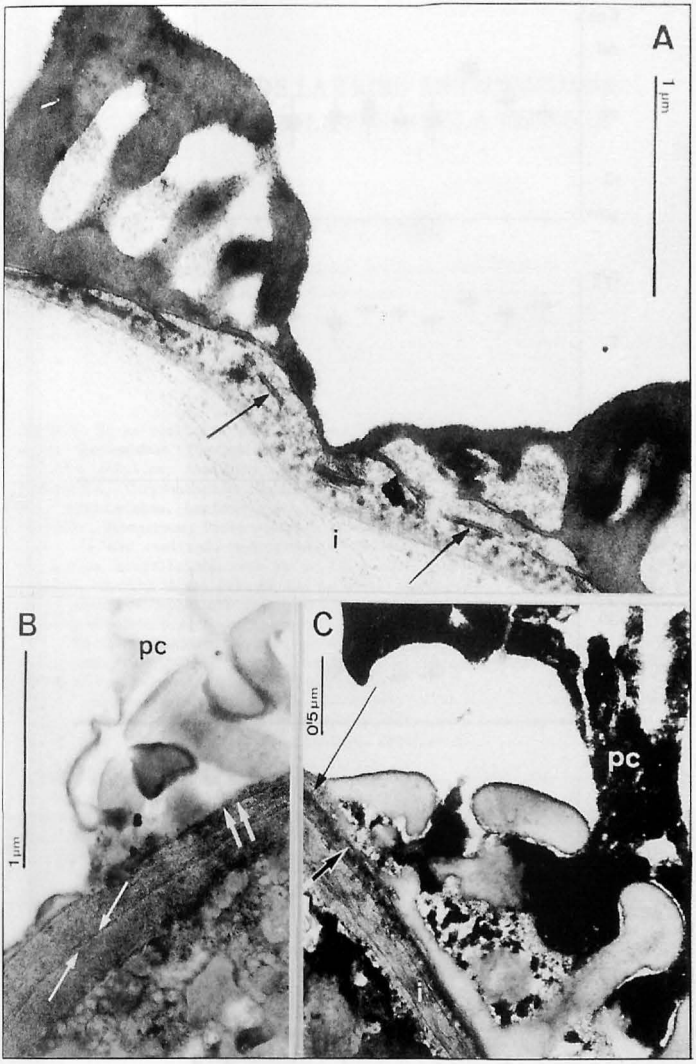
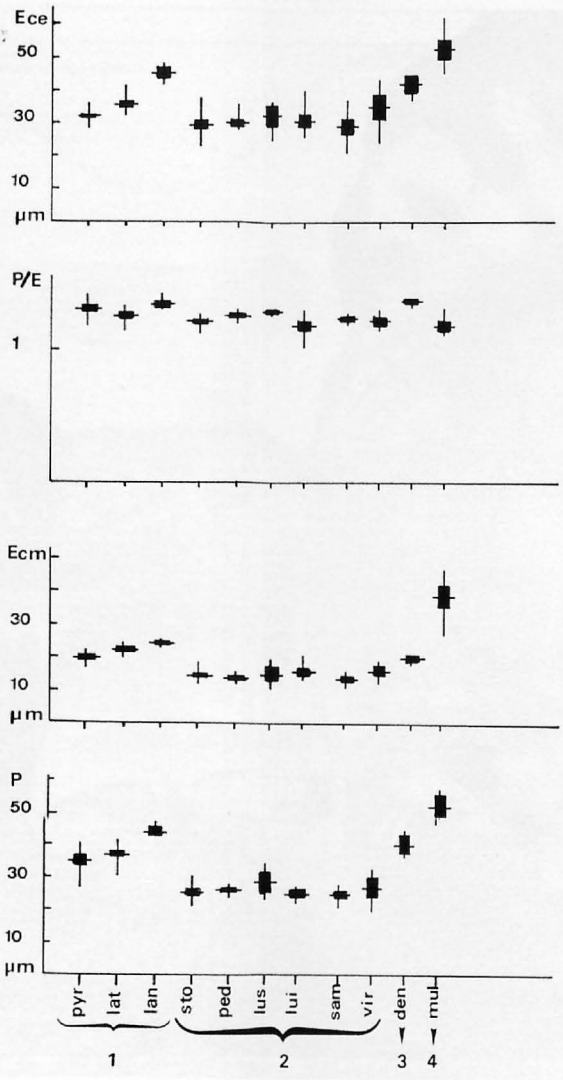


FIGURE VI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