Polen 10:79-91(1999)

AEROBIOLOGICAL DYNAMICS OF THE URTICACEAE POLLEN IN SPAIN, 1992–98

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SUMMARY: In Spain, the Urticaceae family is composed of four genera: *Urtica* (five species), *Parietaria* (three species), and *Soleirolia* and *Forsskaolea* (one species each). The synonymy of the scientific names of these species in Spain is given, together with their distribution and flowering periods. Urticaceae (*Parietaria*) pollen is allergenically important. The pollen records from 1992–98 at 15 sites of the Spanish Aerobiology Network (Red Española de Aerobiología, REA) are studied. There is no part of Spain free of Urticaceae pollen; it is abundant in temperate urban environments near the littoral, but rare in the inland and colder regions. The pollen is present all the year round, and pollination periods may differ from place to place because the proportions of the species composing this taxon change. The pollen quantities recorded depend, not only on meteorological factors, but also on human activities. In this paper, the use of pollen categories instead of pollen concentrations is recommended in order to simplify the presentation of the information. These categories must be specific for each pollen type and, in their definition, the allergy sensitization level must be considered. Finally, the use of the main pollen season (MPS) in the characterization of the aerobiological dynamics of Urticaceae is discussed.
KEY WORDS: Aerobiology, allergy, *Parietaria*, pollen categories, pollen levels, Spain, *Urtica*.

RESUMEN: En España la familia Urticaceae está compuesta por 4 géneros: *Urtica* (cinco especies), *Parietaria* (tres especies), y *Soleirolia* y *Forsskaolea* (una especie cada uno). Junto a la distribución y la floración de estas especies se dan los sinónimos de los nombres científicos en España. El polen de urticáceas (*Parietaria*) tiene importancia alergénica. En este trabajo se analizan los registros polínicos de Urticaceae de 15 estaciones de la Red Española de Aerobiología (REA), recogidos durante el período 1992–1998. Prácticamente, no hay ninguna zona de España libre de polen de urticáceas. Es abundante en las zonas urbanas templadas próximas al litoral, y rara en las áreas interiores frías. El polen está

presente en la atmósfera durante todo el año, aunque los períodos de polinización difieren de un lugar a otro, debido a que las proporciones de las diferentes especies que componen este taxon varían de un lugar a otro. Las cantidades de polen registradas dependen no sólo de los factores meteorológicos sino también de la actividad humana. En este trabajo se dan argumentos a favor del uso de categorías polínicas en lugar de concentraciones, para simplificar la presentación de la información . Estas categorías deberían ser específicas para cada tipo polínico, y al establecerlas se deben tomar en consideración el nivel de sensibilización alérgica. Finalmente, se discute el uso del período de polinización principal para caracterizar la dinámica aerobiológica de Urticaceae.
PALABRAS CLAVE: Aerobiología, alergia, categorías polínicas, España, niveles polínicos, *Parietaria, Urtica*.

INTRODUCTION

The Urticaceae family consists of about 52 genera and 1050 species mainly distributed in tropical and subtropical regions, with relatively few species in the temperate areas. Only 10 species are native to the Iberian peninsula; some of them are widespread, but others grow in only a very restricted area. They are generally herbs or small shrubs, although on rare occasions they may be climbers and have opposite or alternate simple leaves. Plants are mostly anemophilous and dioecious, monoecious or polygamous. Flowers are unisexual, small and individually inconspicuous, mainly in axillary or terminal spike-like cymose inflorescences. Male flowers contain four to five stamens, seldom only one, which develop curved inwards. When the resistance offered by the perianth is overcome, usually in sunny dry weather, the filaments suddenly straighten and the anthers dehisce and eject a small cloud of pollen grains. Female flowers present four, sometimes five, distinct or more or less connate sepals, or no perianth, and an ovary superior. Fruits are achenes. Information about the Urticaceae family can be found in BOLÒS & VIGO (1989), HEYWOOD (1964), MABBERLEY (1987), and WEBERLING (1989).

Species	Flowering period	Habitat	Altitude (m)	Geographical distribution
Urtica bianorii (Knoche) Paiva (=*U. atrovirens* subsp. *bianorii* (Knoche) Font i Quer and Garcias Font)	V–VIII	Wastelands near the coast	350–1000	Mallorca
				Endemic of some islands in W of the Mediterranean region
Urtica dioica L.	IV–IX	Wastelands, arable lands and near buildings	100–2500	Throughout Iberian peninsula except the driest areas in the SE
				Throughout Europe and Asia, adventive in other temperate regions
Urtica membranacea Poir. in Lam.	II–IX	Wastelands, near buildings and disturbed areas	0–1000	Coast areas of all Iberian peninsula
				Mediterranean region
Urtica pilulifera L.	II–IX	Wastelands, near buildings and disturbed areas	0–1000	Mainly in the E of the Iberian peninsula but although in the C.
				Mediterranean region and SW Asia
Urtica urens L.	III–X	Arable lands, wastelands and near buildings	0–1500	Throughout Iberian peninsula
				Throughout Europe except in the extreme N, temperate Asia and N Africa, adventive in Australia and America

TABLE 1. Floral phenology and distribution of the *Urtica* species on the Iberian peninsula.

The *Urtica* genus is the best represented, with five wild species found in the Iberian peninsula. They are mainly annual or perennial herbs and generally have stinging hairs. Table 1 summarizes the floral phenology and the main distribution characteristics of the nettles growing on the Iberian peninsula.

The *Parietaria* genus consists of about 20 species, but only three of them grow as natives on the Iberian peninsula. They are annual or perennial herbs, usually pubescent and do not have stinging hairs. Table 2 summarizes the floral phenology and the main distribution characteristics of the pellitory species growing on the Iberian peninsula.

The remaining two genera are present in a very restricted area on the Iberian peninsula. The *Soleirolia* genus, with a single species (*Soleirolia soleirolii*), is a creeping perennial herb native to the islands of the west Mediterranean region. It can be found both cultivated or naturalized. The *Forsskaolea* genus consists of six species, but only *F. tenacissima* grows on the Iberian peninsula, and exclusively in Almería. Table 3 summarizes the floral phenology and the main distribution characteristics for these two species on the Iberian peninsula.

It is well known that, in Europe, *Parietaria* pollen elicits severe pollinosis, and no cross-reaction has been found between *Parietaria* and *Urtica* pollen (LEWIS *et al.*, 1983). While *Parietaria* is a well-known pollinosis-provoking plant, typical of the Mediterranean area, *Urtica* is allergenically unimportant (D'AMATO *et al*., 1991). The very long period over which *Parietaria* pollen is present in the atmosphere causes the multiseasonal duration of the symptoms shown by sensitized patients. It is also possible to find perennial symptoms (D'AMATO *et al*., 1991).

Since *Urtica* and *Parietaria* pollen grains cannot be distinguished under light microscopes (only *U. membranacea* can be clearly recognizable), aerobiological results usually refer to Urticaceae pollen.

Despite the allergenic significance of this pollen type, little research has been devoted to finding critical thresholds for allergic symptoms in patients. D'AMATO *et al*. (1991) estimates the threshold for *Parietaria* is 30 pollen grains per cubic meter of air (p/m^3). NEGRINI *et al.* (1992) found mild symptoms with concentrations above 10-15 p/m^3 and severe symptoms when the pollen count exceeded 80 p/m^3 over 24 h.

Species	Flowering period	Habitat	Altitude (m)	Geographical distribution
Parietaria judaica L. *(=P. officinalis* L. subsp. *judaica* (L.) Béguinot; *= P. ramiflora* Moench; *= P. diffusa* Mert. and Koch)	March–October	Walls, near buildings and verges	0–1500	Throughout Iberian peninsula
				SW of Asia, S and W Europe and Mediterranean region
Parietaria lusitanica L.	May–July	Walls and near buildings	0–500	Several areas in E and S of Iberian peninsula
				Mediterranean region and SW Asia
Parietaria mauritanica Durieu	March–May	Walls and near buildings	0–700	Mainly in the S of the Iberian peninsula
				NW of Africa and SW Europe

TABLE 2. Floral phenology and distribution of the *Parietaria* species on the Iberian peninsula.

Urticaceae pollen appears in the atmospheric spectra at all Spanish sites (as noted by several authors in REA (Red Española de Aerobiología) bulletins 1 and 3–5. This taxon has been treated with special emphasis by the following authors: ROURE and BELMONTE (1987), who first attempted to predict pollination levels; TRIGO *et al.* (1996), who looked at annual, daily and diurnal variations in Málaga; ALCÁZAR *et al.* (1998), who studied the vertical variation of pollen concentrations at Córdoba; and CHAPARRO (1987), who summarized Urticaceae pollen counts in Andalucía from 1981 to 1983. Comparisons of pollen dynamics at several Spanish sites have also been studied (SUBIZA, 1987; MAÑAS *et al.*, 1990; BELMONTE & ROURE, 1991; GONZÁLEZ *et al.*, 1998).

MATERIAL AND METHODS

In the present paper Urticaceae pollen aerobiological data from 15 Spanish sites during the period 1992–98 were analysed. All of the stations are integrated in REA, the Spanish Aerobiology Network. Table 4 contains the names of the aerobiological sampling stations and their main geographical and climatic characteristics. The duration of the sampling periods in each station is in Table 5.

All data were obtained using seven-day volumetric Hirst-type spore traps (HIRST, 1952), following the method adopted by REA (DOMÍNGUEZ *et al.*, 1991). Only complete annual series were included in this study. Gaps in the data series have been filled by linear interpolation. When this was not realistic because of the amount of missing data, the whole annual series was excluded from the study. The basic data are, as usual, the mean daily pollen concentration expressed in the number of pollen grains per cubic meter of air (p/m^3).

In the analysis of the variation of this pollen at the sites studied, four aspects have been considered. In the annual summary, we give, for each station and year, the sum of the 365 mean daily concentrations (annual sum), the highest mean daily concentration of the year (maximum), and the corresponding date. We have established the main pollen season (MPS) following NILSSON and PERSSON (1981) and have included in the summary the total pollen during the MPS, the beginning and ending dates, and the duration.

In the third area of analysis, daily pollen concentrations have been transformed into an ordinal, 0–4 scale. The categories for the ordinal scale were defined in a previous

Species	Flowering period	Habitat	Altitude (m)	Geographical distribution
Soleirolia soleirolii (Req.) Dandy	March–October	Caves, cliffs and rocks	50–700	Mallorca Islands of W Mediterranean region
Forsskaolea tenacissima L.	April–October	Dry wasteland and sandy soils	-	Almería SE Iberian peninsula, Asia Minor and N Africa

TABLE 3. Floral phenology and distribution of the *Soleirolia* and *Forsskaolea* genus on the Iberian peninsula.

study (BELMONTE *et al*., in press) and are based on the experience of the research group. The ordinal scale defined for herb plants (Urticaceae in this paper) is presented in Table 5, where *n* corresponds to mean daily pollen concentrations.

Finally, looking for a graphical synthesis of the annual dynamics of the pollen at each site, a week has been used as the time unit. Following the convention that the first week of the year is the one that contains the first Thursday, we have converted each daily data series into the corresponding mean weekly pollen concentrations. Then we have calculated, for each station and week of the year, the mean value and the highest value of the period studied. Two series for each site, one for the mean, and the other for the maximum, are plotted in each of the line charts of Figures 1, 2 and 3.

RESULTS AND DISCUSSION

Table 5 can be analysed from several points of view. Looking at the amount of pollen collected throughout the year (annual sum), the site where Urticaceae pollen atteined the highest level was Vigo, followed by the Mediterranean stations Manresa, Girona, Tarragona and Barcelona, the Andalusian stations Granada and Córdoba, and also the Mediterranean station Bellaterra. León and Madrid were, by far, the sites with the lowest levels, followed by Santiago de Compostela, Málaga, Lleida, Jaén, and Estepona.

The explanation for this pollen distribution is as follows. Urticaceae pollen is abundant in urban environments near to the littoral, but rare in the inland and colder regions of the peninsula. Some southern cities with large, old neighbourhoods also produce important quantities of Urticaceae pollen, possibly due to the abundance of habitats where *Parietaria* plants grow. This is in accord with the results reported in the Spanish literature cited in the Introduction (GONZÁLEZ *et al*., 1998; MAÑAS *et al*., 1990). Nevertheless, the results of this study do not favour the argument that relates the

		Geographical characteristics		Climatic characteristics		
Geographical Region	Aerobiological Station	Altitude (m)	Geographical Coordinates	Mean Annual Temperature (ºC)	Annual rainfall (mm)	Climate type (Capel, 1981)
North-East	Girona	125	41º 54' N, 02º 46' E	15,0	740	Mediterranean
	Manresa	291	41º 44' N, 01º 30' E	13,5	605	Mediterranean
	LLeida	202	41º 37' N, 00º 38' E	14,8	414	Mediterranean
	Bellaterra	245	41º 34' N, 02º 06' E	15,2	611	Mediterranean
	Barcelona	90	41º 24' N, 02º 09' E	16,5	595	Mediterranean
	Tarragona	48	41º 07' N, 01º 15' E	16,7	482	Mediterranean
North-West	Santiago	270	42º 53' N, 08º 32' W	12,9	1288	Temperate cold oceanic
	Vigo	50	42º 14' N, 08º 43' W	14,9	1412	Temperate cold oceanic
North	León	830	42º 34' N, 05º 35' W	10,0	550	Temperate cold continental
Center	Madrid	600	40º 27' N, 03º 45' W	14,0	446	Temperate cold continental
South	Córdoba	123	37º 50' N, 04º 45' W	18,0	600	Mediterranean continental
	Jaen	560	37º 46' N, 03º 47' W	17,0	592	Mediterranean continental
	Granada	685	37º 11' N, 03º 35' W	15,1	400	Continental mediterranean
	Málaga	5	36º 47' N, 04º 19' W	18,0	575	Mediterranean subtropical
	Estepona	0	36º 25' N, 05º 09' W	16,8	556	Mediterranean subtropical

TABLE 4. Aerobiological sampling stations and main geographical and climatic characteristics.

amount of Urticaceae pollen to the level of industrial activity at a site (GONZÁLEZ *et al*., 1998; JÄGER *et al*., 1991).

Taking into consideration the mean daily maximum concentration (Table 5), Vigo is once again the station where the higher values were obtained, with 404 p/m^3 on 29/03/96. Stations where important daily maximum levels were also reached were Girona (303 p/m^3 on 22/02/98) and Granada (305 p/m^3 on 15/02/98). The lowest mean daily maximum concentrations observed in a year were 13 p/m^3 at León on 15/08/95 and at Madrid on 04/05/97.

Two different ways to analyse the prevalence of Urticaceae pollen in the atmosphere are presented in Table 5 and Figures 1, 2 and 3. In Table 5, mean daily pollen concentrations for each station and year have been categorized and presented in the form of frequencies related to a 0–4 ordinal scale. According to the experience of the Catalan research group, levels 0 and 1 (< 5 p/m^3) are not suspected of causing allergic reactions. Problems in highly sensitized patients appear when level 2 (5-20 p/m^3) is reached and the pollen clearly causes allergic responses in people when concentrations reach levels 3 (20-30 p/m^3) or 4 (> 30 p/m^3). It has to be taken into account that in the Catalan stations (those cited as north-east stations in Table 4), most of the Urticaceae pollen is supposed to be, by phenological and plant distribution observations, *Parietaria* pollen.

These results make us think that the thresholds for allergic symptoms proposed in the literature are too high for the Spanish stations. In the Barcelona area, where it is the main pollen allergen, the prevalence of sensitivity to *Parietaria* is 3.5% (BOTEY *et al*., 1998). In Vigo, *Parietaria* causes 12% of pollinosis and is the second most important pollen allergen (MARCH *et al*., 1993; BELMONTE *et al*., 1998). In their study at La Coruña, FERREIRO & RICO (1995) reported that the pollinosis rate was 11%. CHAPARRO (1987) observed that *Parietaria* was responsible for 5.5% of the pollinosis observed in Andalucía. In 9.46% of the vaccine prepared for allergic patients in the Granada province the extract of *Parietaria judaica* appeared (DÍAZ DE LA GUARDIA, 1995). The *Parietaria* pollen produces skin positives in 6.5% of observed patients in Zaragoza (BELMONTE *et al*., in press).

As could be expected, there is a correlation between high annual sums of Urticaceae pollen and the number of days when pollen levels 3 and 4 are reached. At sites with low annual pollen totals, level 4, and even level 3, are rarely reached.

Figures 1, 2 and 3 present an alternative argument to discuss the prevalence of Urticaceae pollen. Attention needs to be paid to the scales in the graph, which show that Urticaceae pollen is continuously present in the atmosphere of the sites studied. Annual curves present different forms between places, possibly due to the diverse species gathered under this taxon. If ever the most convenient environmental conditions occurred, the pollen concentrations (represented here by the potential curve) should be a lot higher than the usual (mean curve) concentrations. In the Mediterranean localities, the pollen values seem to be less variable than in the southern localities, where important differences between years (Table 5), and between the mean and the maximum are observed.

The Urticaceae pollen quantities registered depend not only on meteorological factors affecting growth and flowering, but

		Annual summary			Main Pollen Season				Number of days per Category				
Site	**Years**	**Annual sum P/m³**	**Maximum P/m³**	**Maximum Date**	**Pollen sum P/m³**	**Beginning Date**	**Ending Date**	**Duration No. days**	**Cat. 0 (n=0)**	**Cat. 1 (0<n<5)**	**Cat. 2 (5£n<20)**	**Cat. 3 (20£n<30)**	**Cat. 4 (n³30)**
Girona	1996	7215	139	14/04	6515	4/04	15/10	195	54	80	114	36	82
	1997	7853	134	16/07	7083	22/03	22/09	185	21	117	76	35	116
	1998	6275	330	22/02	5656	5/02	12/12	311	123	141	36	12	53
Manresa	1996	6180	141	26/05	5603	13/04	14/11	216	20	130	102	47	67
	1997	10710	274	6/05	9670	21/03	13/09	177	26	92	97	25	125
	1998	4802	150	11/06	4327	17/03	1/10	199	44	129	122	19	51
Lleida	1996	1575	36	20/04	1420	18/03	22/10	219	64	198	97	6	1
	1997	1180	26	6/04	1062	26/02	24/09	211	118	163	78	6	0
	1998	1490	32	23/05	1345	20/03	12/09	177	119	140	98	7	1
Bellaterra	1994	3263	56	29/04	2942	7/03	18/10	226	41	166	102	26	30
	1995	2616	58	24/06	2364	12/03	17/09	190	41	173	116	27	8
	1996	2916	85	15/06	2627	26/03	29/10	218	41	172	107	24	22
	1997	4854	84	15/07	4369	7/03	22/08	169	56	134	76	38	61
	1998	2597	51	12/05	2346	5/03	21/09	201	44	177	109	22	13
Barcelona	1994	4932	107	25-26/04	4449	2/03	15/11	259	28	125	134	30	48
	1995	3612	99	8/04	3252	20/02	19/10	242	21	170	120	27	27
	1996	5203	103	12/04	4683	25/03	23/10	213	23	139	116	34	54
	1997	6688	144	7/07	6025	5/03	19/08	168	29	144	83	31	78
	1998	4008	106	3/04	3613	4/03	29/10	240	28	154	124	22	37
Tarragona	1996	7383	153	26/05	6657	11/03	13/11	248	36	74	148	29	79
	1997	6511	134	27/04	5901	15/02	10/10	238	16	108	137	37	67
	1998	5459	132	17/05	4915	19/02	10/10	234	17	139	124	27	58
Santiago de Compostela	1993	863	33	28/05	779	12/02	19/09	220	147	159	55	3	1
	1994	813	18	27/06	734	12/04	9/11	212	119	183	63	0	0
	1995	813	31	19/06	734	22/03	6/11	230	125	183	56	0	1
	1996	534	16	25/03	482	17/03	23/10	221	149	193	24	0	0
	1997	2180	53	27/07	1967	25/02	14/09	202	78	149	112	15	11
	1998	1269	73	10/02	1177	10/01	14/05	125	217	95	29	12	12
Vigo	1995	8066	291	22/03	7314	18/02	26/09	221	50	82	118	27	88
	1996	10259	404	29/03	9263	20/02	25/08	188	53	100	102	26	85
	1997	10067	262	5/03	9019	5/02	23/08	200	55	90	90	27	103
	1998	7471	116	18/06	6730	10/02	25/08	197	38	92	102	41	92
León	1994	385	15	26/06	350	5/06	28/08	85	273	65	27	0	0
	1995	463	13	15/08	420	31/05	30/08	92	248	80	37	0	0
	1996	547	20	11/06	496	26/04	7/09	135	236	93	36	1	0
	1997	214	17	24/06	194	31/03	28/06	90	297	56	12	0	0
	1998	559	23	17/06	507	23/05	20/08	90	255	66	41	3	0
Madrid	1994	693	21	13/03-1/06	628	5/03	15/10	225	207	108	48	2	0
	1995	452	16	7/07	408	5/02	31/08	208	171	170	24	0	0
	1996	848	22	23/03	764	11/03	6/08	149	148	152	63	3	0
	1997	541	13	4/05	492	21/02	5/08	166	203	124	38	0	0
	1998	677	18	2/06	613	14/02	9/07	146	205	111	49	0	0
Córdoba	1992	696	22	4/12	629	2/02	21/12	324	132	189	44	1	0
	1993	2115	175	1/12	1913	28/01	1/12	308	92	156	95	15	7
	1994	1582	109	30/04	1437	12/01	4/12	327	140	147	61	8	9
	1995	1650	127	30/12	1561	11/02	30/12	323	190	93	62	14	6
	1996	7754	224	24/03	7080	1/02	14/12	318	72	95	90	32	77
	1997	5649	185	12/03	5124	5/02	22/12	321	61	127	102	21	54
	1998	4358	235	22/04	3931	4/01	11/08	220	66	147	107	13	32
Jaén	1996	1492	69	24/03	1348	6/02	19/07	165	119	168	61	9	9
	1997	1621	36	19/03	1465	8/02	28/10	263	87	176	79	21	2
	1998	1589	45	15/02	1432	24/01	17/07	175	104	160	83	12	6
Granada	1992	3017	70	17/12	2737	26/02	21/12	300	45	132	148	25	16
	1993	4411	73	8/04	3986	27/01	8/12	316	16	121	153	39	36
	1994	5226	183	3/03	4726	26/01	13/11	292	18	148	128	32	39
	1995	2546	53	16/02	2301	5/02	21/11	290	59	145	129	14	18
	1996	4624	161	8/02	4184	13/01	27/11	320	49	136	102	29	50
	1997	4228	184	30/12	3838	25/01	29/12	339	35	115	148	36	31
	1998	5850	305	15/02	5315	11/01	24/07	195	56	114	104	31	60
Málaga	1992	912	17	18/03	823	27/01	23/11	302	93	224	49	0	0
	1993	1243	29	7/04	1121	2/02	18/12	320	85	200	73	7	0
	1994	1534	47	21/03	1385	16/01	28/11	317	73	194	89	5	4
	1995	1078	46	18/03	977	28/01	6/11	283	107	201	49	5	3
	1996	2102	66	14/04	1893	22/01	24/10	277	55	191	104	4	12
	1997	1105	26	17/02	1000	8/02	30/11	296	77	216	69	3	0
	1998	1151	27	1/03	1038	17/01	25/07	190	102	178	79	6	0
Estepona	1996	4081	166	27/03	3702	3/02	6/06	125	107	135	67	16	41
	1997	993	31	22/02	899	4/02	7/11	277	98	202	62	2	1

TABLE 5. Parameters to evaluate the presence and impact of Urticaceae pollen in several Spanish localities

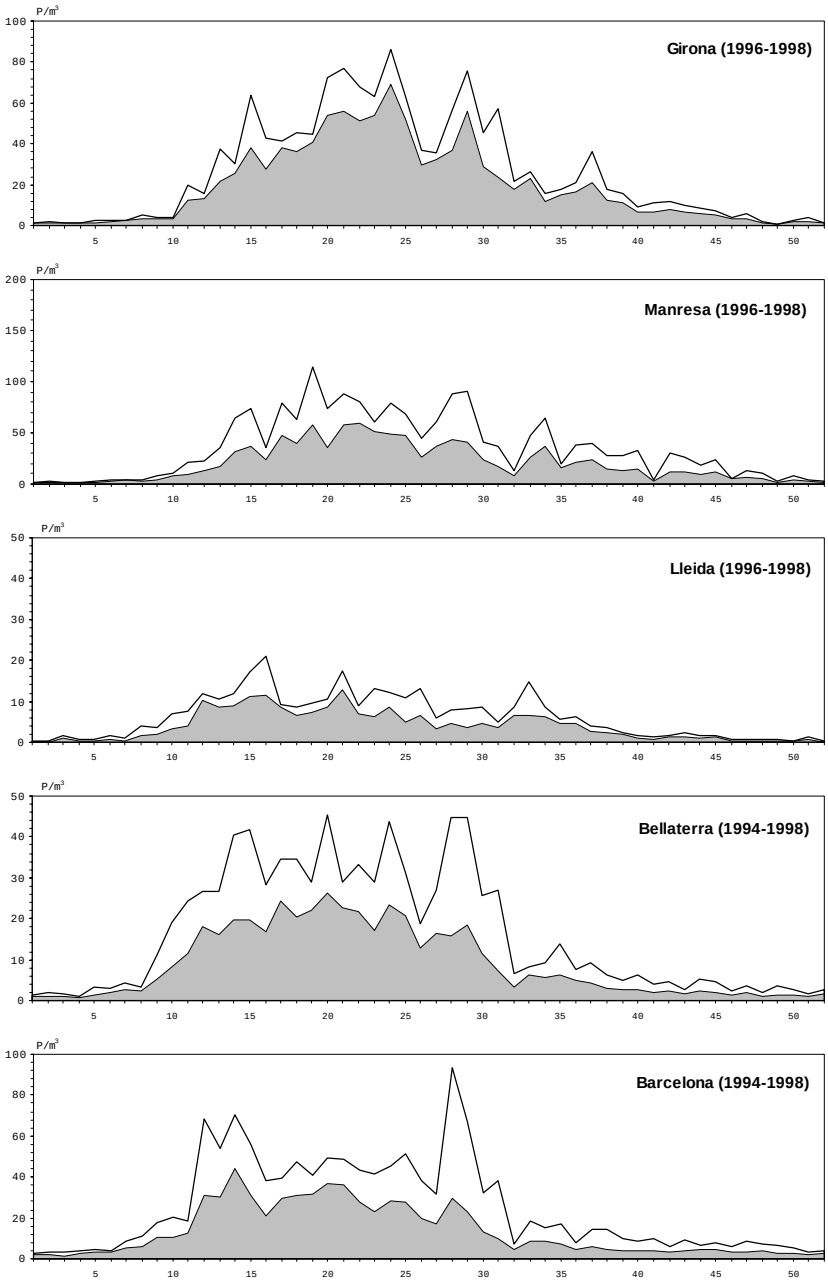

FIGURE 1. Graphical synthesis of the annual dynamics of the Urticaceae pollen at 5 of the 15 REA sites. For each station and week of the year, the mean concentration and the highest concentration of the period studied are plotted.

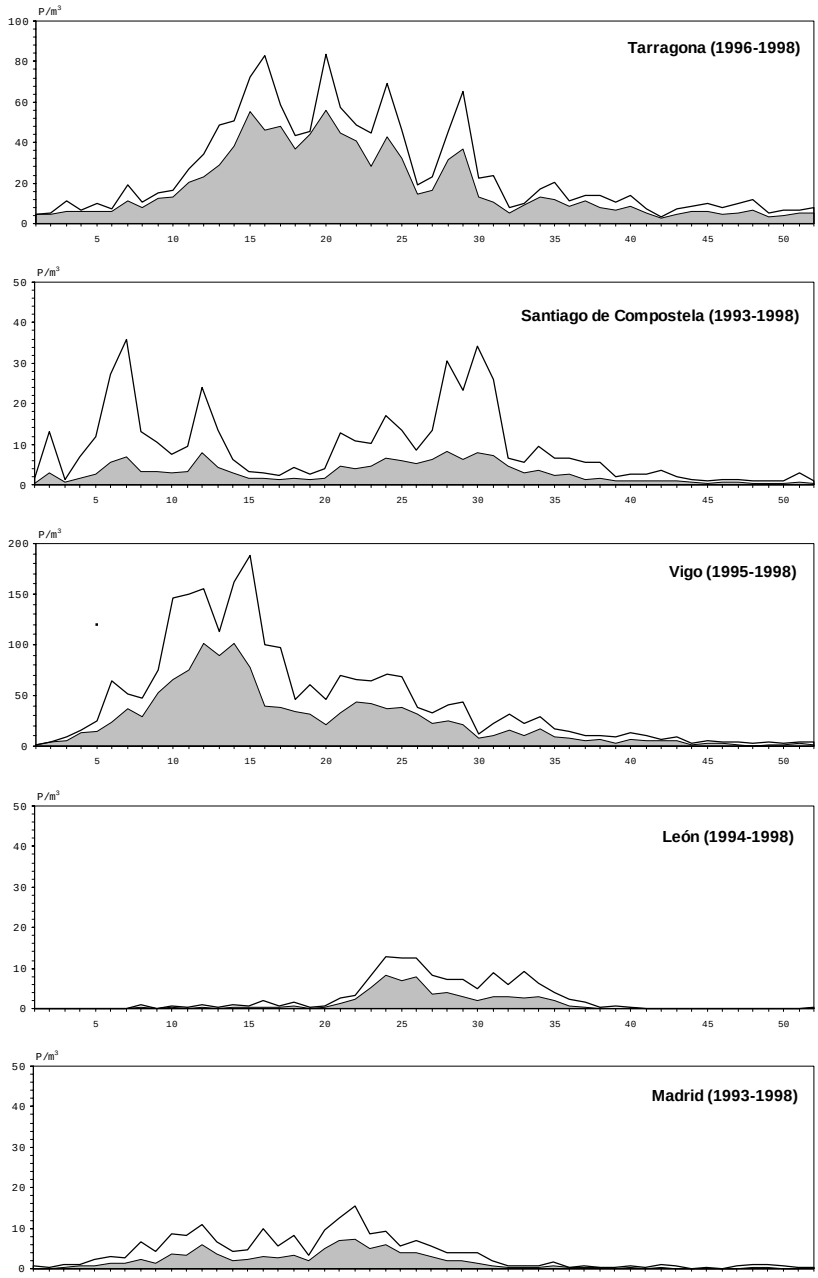

FIGURE 2. Graphical synthesis of the annual dynamics of the Urticaceae pollen at 5 of the 15 REA sites. For each station and week of the year, the mean concentration and the highest concentration of the period studied are plotted.

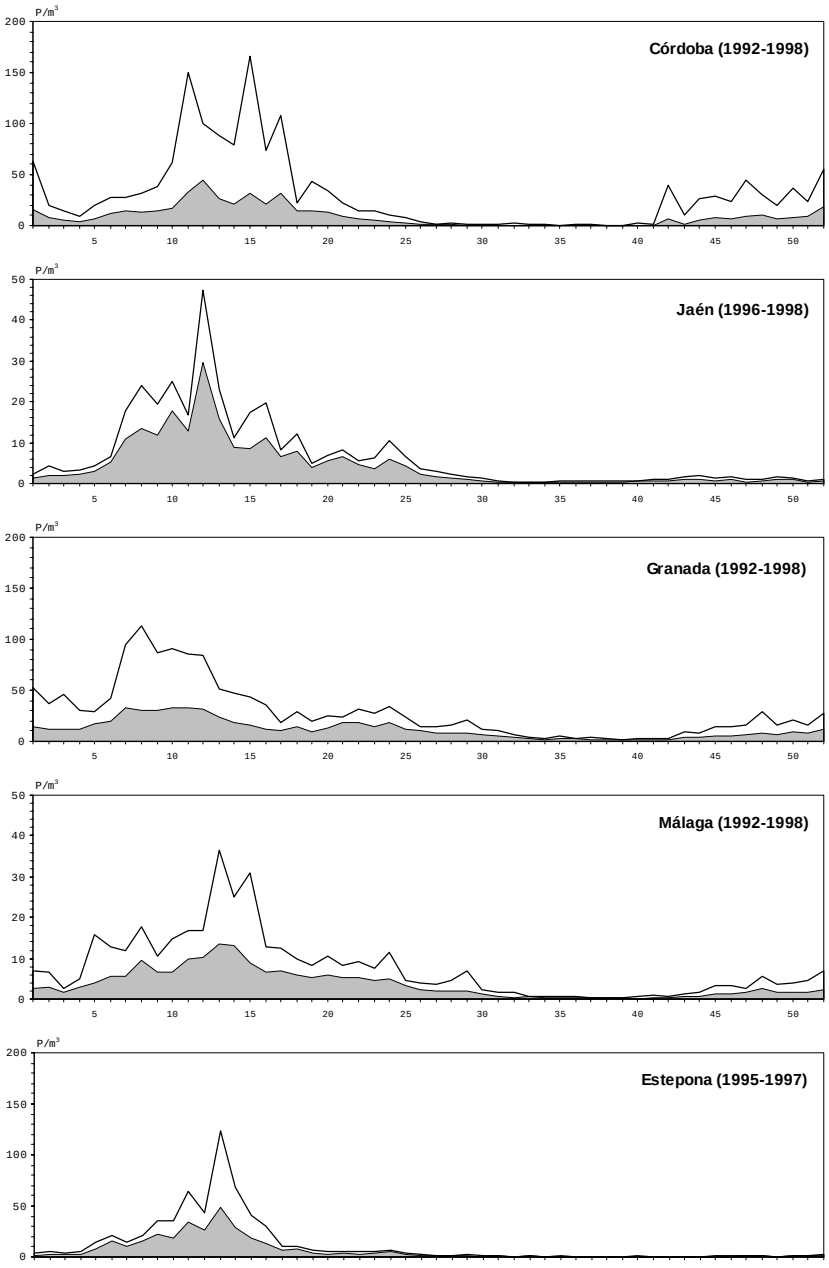

FIGURE 3. Graphical synthesis of the annual dynamics of the Urticaceae pollen at 5 of the 15 REA sites. For each station and week of the year, the mean concentration and the highest concentration of the period studied are plotted.

also on human activities. This is because the plants of this family are nitrophilous and grow near human sites.

Figures 1, 2 and 3 also provide an argument against the use of MPS-related data as parameters for the characterization of pollen curves. It shows that, while at most sites Urticaceae pollen is released into the atmosphere from the end of autumn to summer, at some other sites the majority of the pollen is released during winter and summer. Therefore, it is not advisable to calculate the MPS in the same way at all of the stations, as we have done in this study. Another argument is derived from Table 5, where it is clearly shown that MPS-related parameters are totally influenced by the amount of pollen in the annual season. They show important oscillations from year to year, but do not contribute any relevant information not already included in the annual summary parameters. The adequacy of this concept for pollen taxa continuously present in the air can also be questioned. It is the author's opinion that a more useful way to describe aerobiological dynamics of allergenic pollen types is by using taxon-specific categories defined according to different sensitization levels.

CONCLUSIONS

Although there is no part of Spain completely free from Urticaceae pollen, there are notable differences in concentrations between regions. Among the sites studied, León and Madrid had the lowest levels. Progressively higher levels of Urticaceae pollen were found in Santiago de Compostela, Málaga, Lleida, Jaén, Estepona, Bellaterra, Córdoba, Granada, Barcelona, Tarragona, Girona, Manresa and Vigo.

Urticaceae pollen was continuously present in the atmosphere of the localities studied and pollination periods differed from place to place due to the different species composing the pollen taxon. The main pollen season does not seem to be useful in characterizing the aerobiological dynamics of pollen types from plants that pollinate all year round. The use of categories instead of pollen concentrations seems advisable in order to simplify the presentation of the information.

The important inter-annual variations of the Urticaceae pollen levels can be explained not only by meteorological parameters but also by human activities. These include periodical elimination or any other actions that can modify the extent of their habitat.

ACKNOWLEDGEMENTS

The data from Barcelona, Bellaterra, Girona, Lleida, Manresa, and Tarragona are part of the research project "Aerobiologyical network of Catalonia" (Xarxa Aerobiològica de Catalunya, XAC), between the Botanical Unit of the Universidad Autónoma de Barcelona and Laboratorios CBF-LETI, S.A.

The authors are grateful to the CICYT for funding project AMB–0457–CO7.

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