Comparative analysis of airborne pollen data and flowering phenology data in Catalonia (North-East Spain)

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OBJECTIVES

- To compare **pollen and flowering data** obtained during eight consecutive years for several taxa with known respiratory allergenic implications

- To establish if there is any **relationship** between flowering monitoring and aerobiological sampling observations

- To conclude if **hybrid networks** (phenological and aerobiological stations) ensure a better forecast of atmospheric pollen taxa and extends the predictions to a wider area

MATERIALS AND METHODS

Aerobiological sampling

- **HIRST** traps (REA's counting methodology)
- Item analyzed is the **date** of the **annual maximum** mean daily pollen concentration (Julian day)

Phenological sampling

- **Daily sighting** (Mr. P. Comas)
- Items analyzed are the **date** of the **maximum flowering phenophase** (Julian day) and the **date** of the **flowering average** for the **period 1952-2000** (Julian day)

Statistics

- **Basic statistics**
- **PEARSON** correlation test


Girona
Manresa
LLeida
Cardedeu
Barcelona
Tarragona

SAMPLING SITES

Sampling stations (study period)	Geographical characteristics			Climatic characteristics		
	Altitude (m.a.s.l.)	Geographical Coordinates	Distance (Km) phenological station	Mean Annual Temperature (ºC)	Annual Rainfall (mm)	Phytoclimates (Allue,1990)
Bellaterra (1994-2001)	190	41º33' N, 02º07' E	25 SW	15.2	594	Fresh-Continental Oriental-semihumid
Barcelona (1994-2001)	12	41º24' N,02º11' E	35 SW	16.4	593	Fresh-Tethyc-semiarid
Manresa (1994-2001)	238	41º43' N, 01º50' E	45 W	13.6	619	Fresh-Continental Oriental-semihumid
Girona (1994-2001)	70	41º59' N, 02º60' E	55 NE	15.0	740	Fresh-Continental Oriental-semihumid
Tarragona (1994-2001)	20	41º07' N, 01º15' E	100 SW	15.8	478	Fresh-Tethyc-semiarid
Lleida (1994-2001)	221	41º37' N, 00º37' E	140 W	15.1	385	Fresh-Transitional-semiarid
Cardedeu (1994-2001) (1952-2000)	193	41º34' N, 02º21' E		14.1	695	Fresh-Continental Oriental-semihumid

Taxa considered

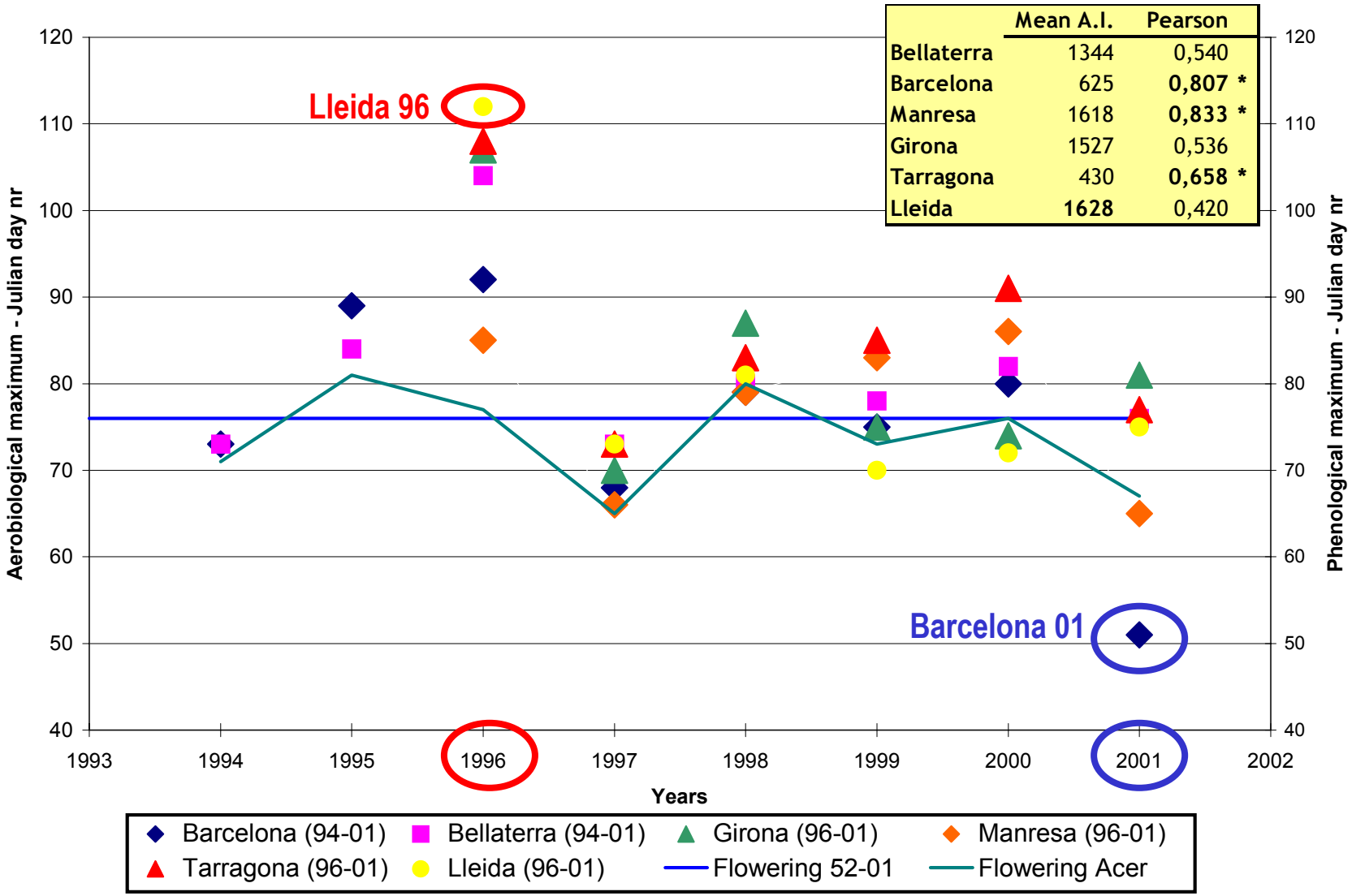
Phenological taxa	Aerobiological taxa
Acacia farnesiana	*Acacia*
Acer monspesulanum	*Acer*
Alnus glutinosa	*Alnus*
Avena sativa	Brassicaceae
Brassica oleracea	*Castanea*
Crataegus monogyna	*Corylus*
Castanea sativa	*Fraxinus*
Cydonia oblonga	Moraceae
Corylus avellana	*Olea*
Fraxinus angustifolia	*Pinus*
Hordeum vulgare	*Platanus*
Malus domestica	Poaceae
Morus alba	*Quercus*
Olea europaea	Rosaceae
Pinus pinea	*Salix*
Platanus hybrida	*Ulmus*
Prunus armeniaca	*Vitis*
Prunus avium	
Prunus domestica	
Prunus dulcis	
Prunus persica	
Pyrus communis	
Quercus faginea	
Quercus ilex	
Quercus suber	
Salix cinerea	
Triticum aestivum	
Ulmus minor	
Vitis vinifera	
Zea mays	

RESULTS

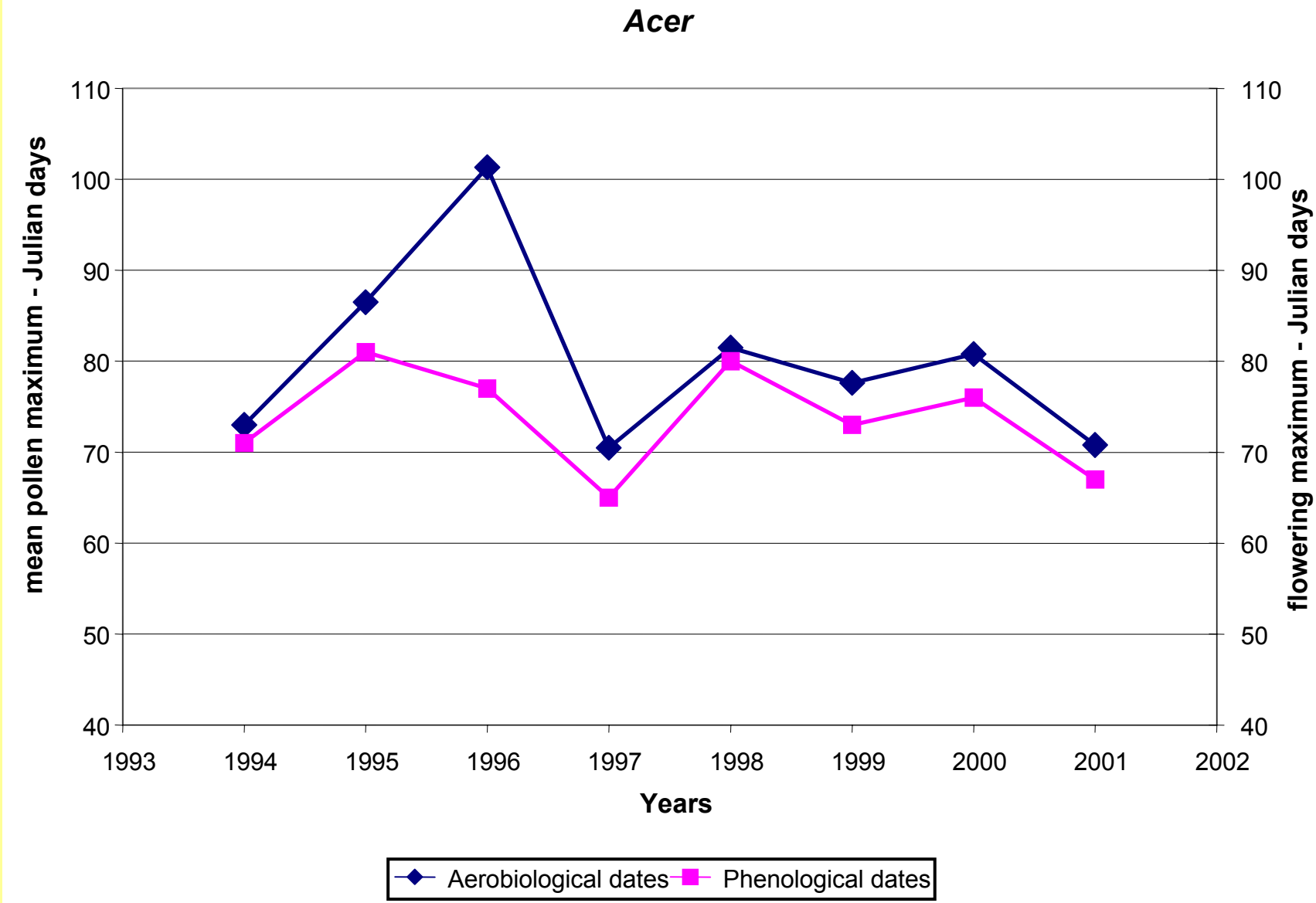
Taxa	Aerobiological stations (increasing distance to Phenological station)					
	Bellaterra	Barcelona	Manresa	Girona	Tarragona	Lleida
Acer	0.540	**0.807 ***	**0.833 ***	0.536	**0.658 ***	0.420
Castanea	**0.640 ***	**0.968 ****	**0.812 ***	0.119	**-0,817 ***	0.520
Fraxinus	**0.702 ***	**0.921 ****	0.406	0.430	0.629	0.569
Olea	0.383	0.507	**0.651 ***	0.190	0.233	0.162
Platanus	0.444	**0.822 ***	0.072	0.274	**0.936 ****	0.192
Km to Cardedeu	25Km	35 Km	45Km	55Km	100Km	140Km
Orientation	SW	SW	W	NE	SW	W

*$p \leq 0.05$ **$p \leq 0.01$

Dates of the maximum pollen concentration and flowering for *Acer*

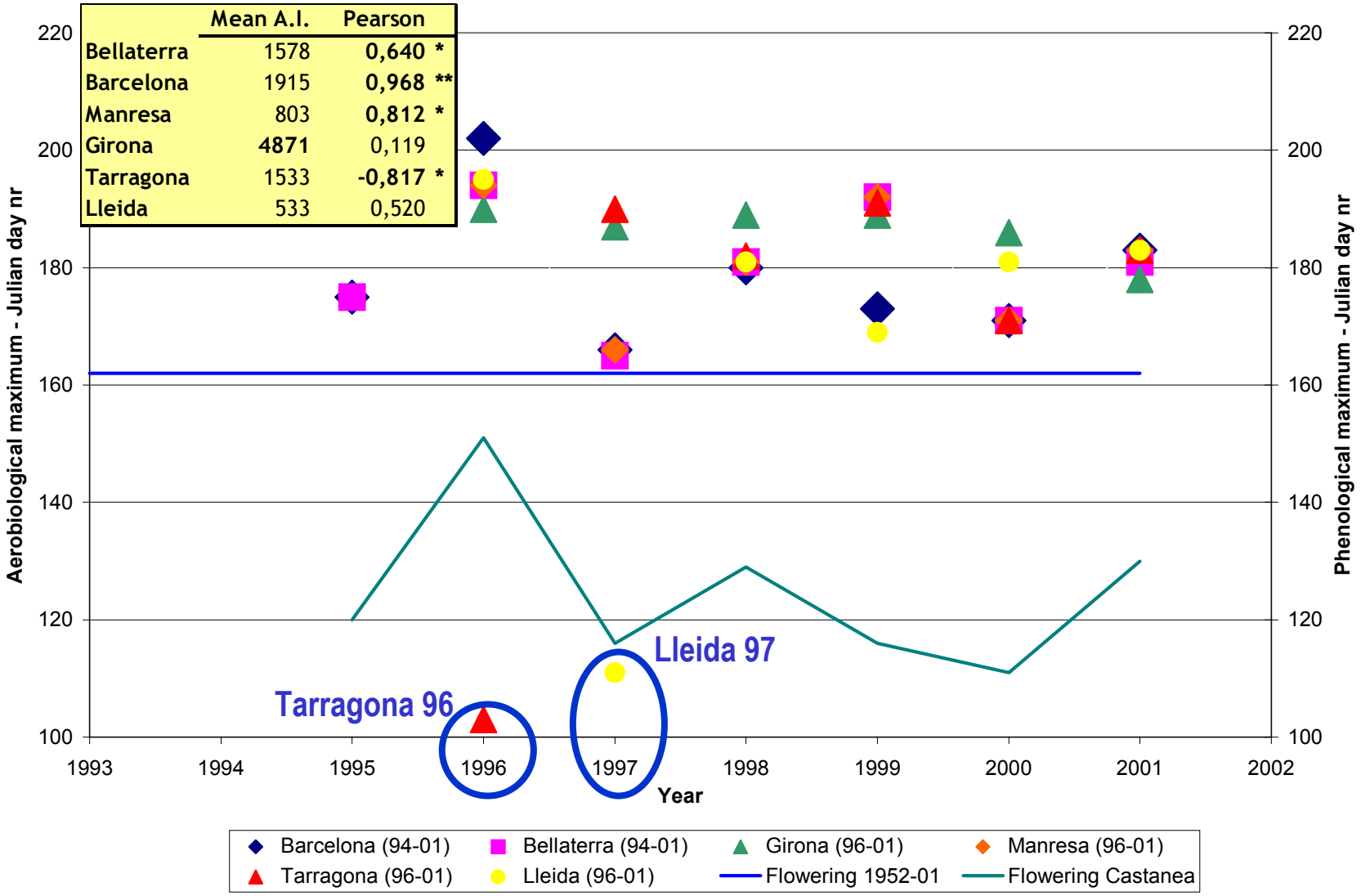


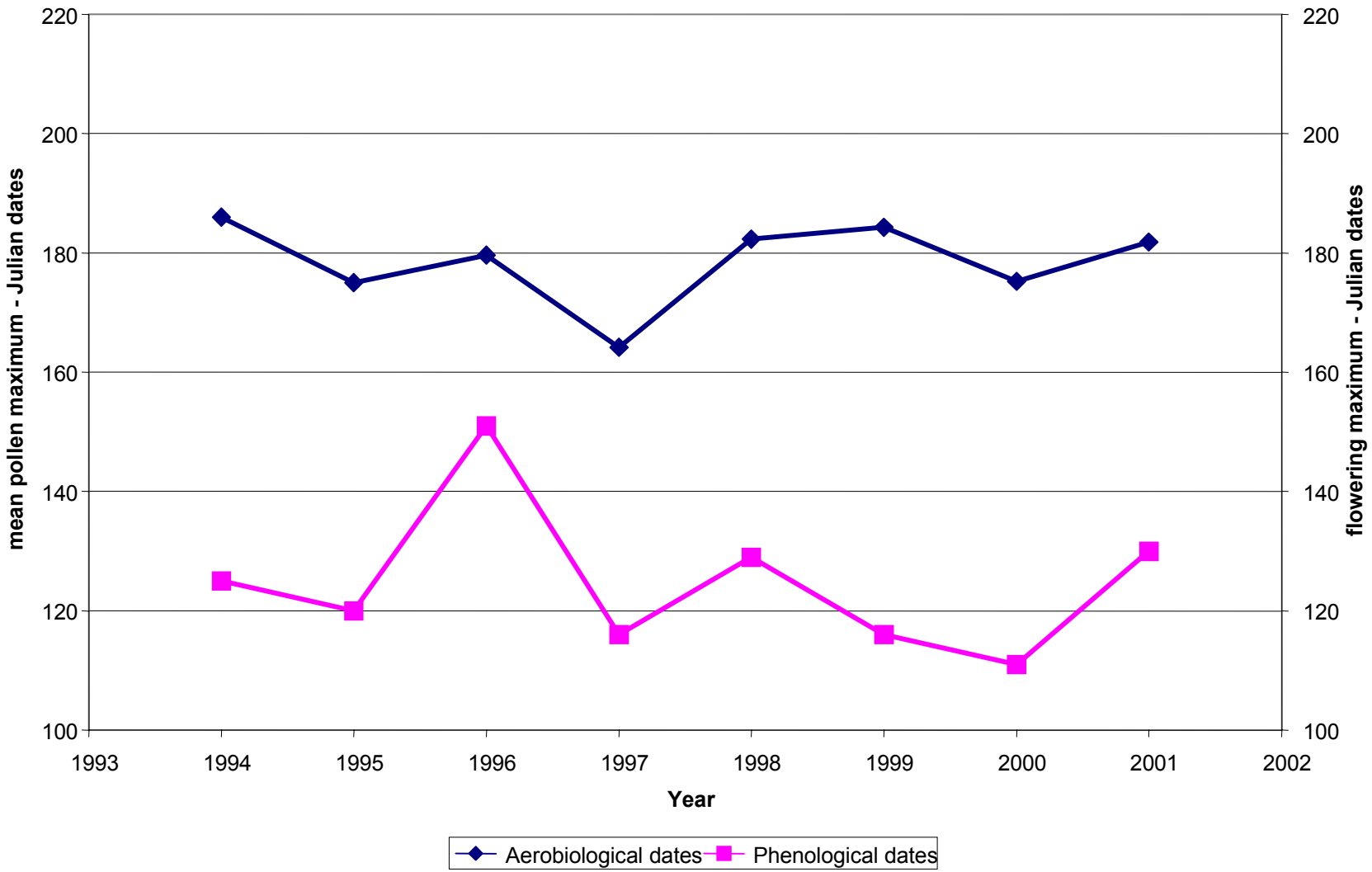
	Mean A.I.	Pearson
Bellaterra	1344	0,540
Barcelona	625	**0,807 ***
Manresa	1618	**0,833 ***
Girona	1527	0,536
Tarragona	430	**0,658 ***
Lleida	**1628**	0,420


Acer
mean pollen maximum - Julian days
flowering maximum - Julian days
110
100
90
80
70
60
50
40
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Years
Aerobiological dates
Phenological dates

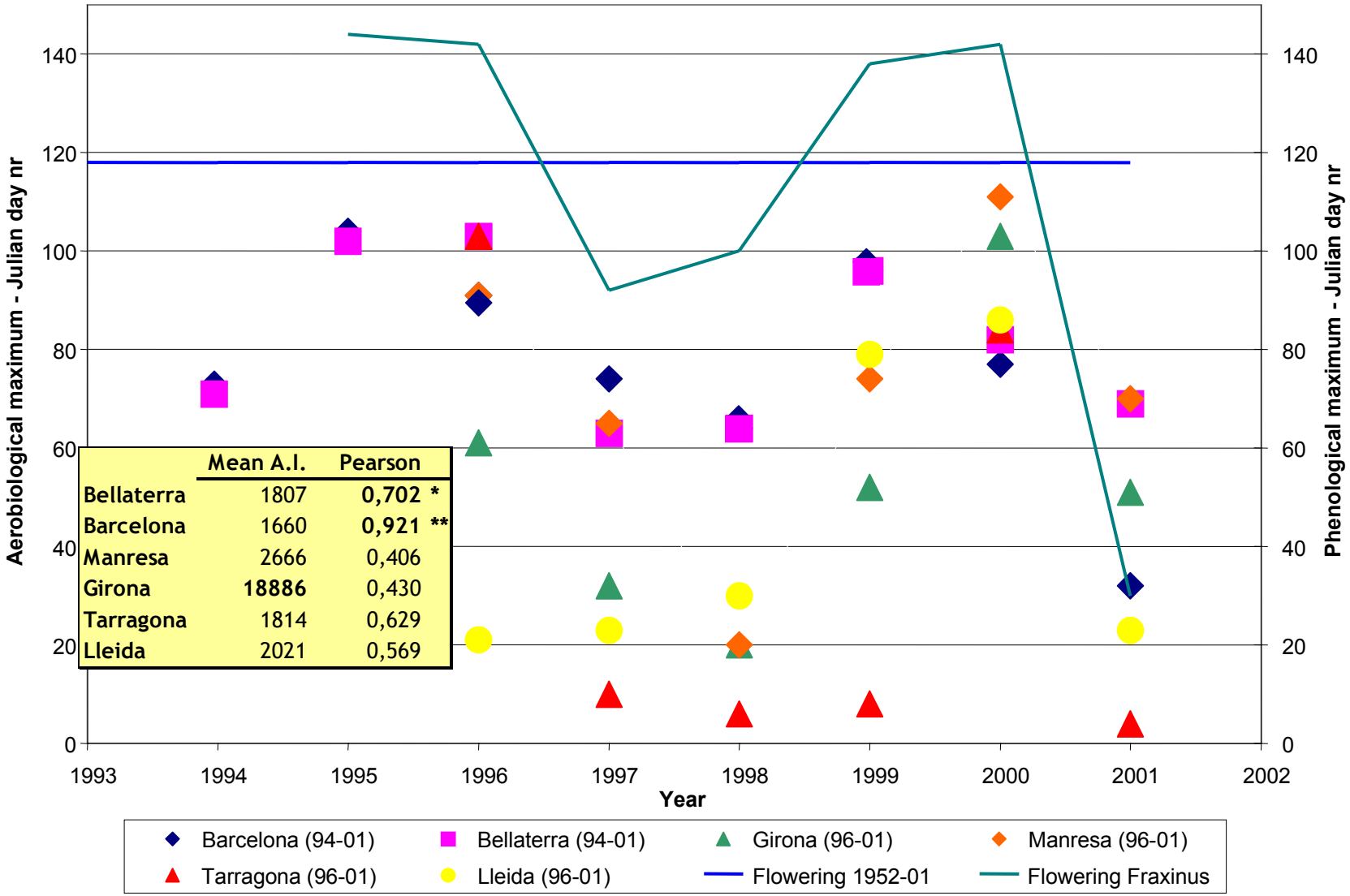
Dates of the maximum pollen concentration and flowering for - *Castanea*

	Mean A.I.	Pearson
Bellaterra	1578	0,640 *
Barcelona	1915	0,968 **
Manresa	803	0,812 *
Girona	4871	0,119
Tarragona	1533	-0,817 *
Lleida	533	0,520

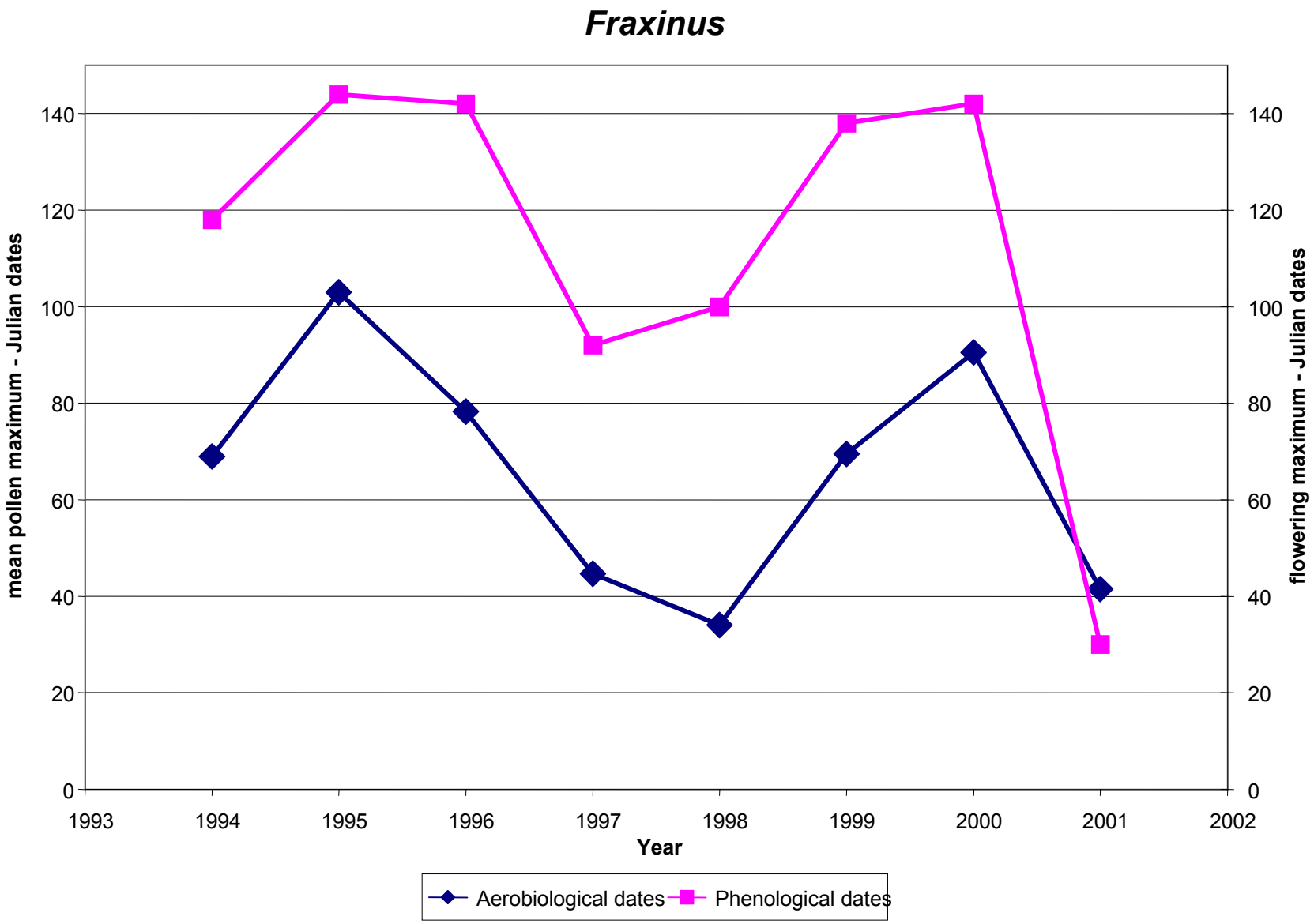


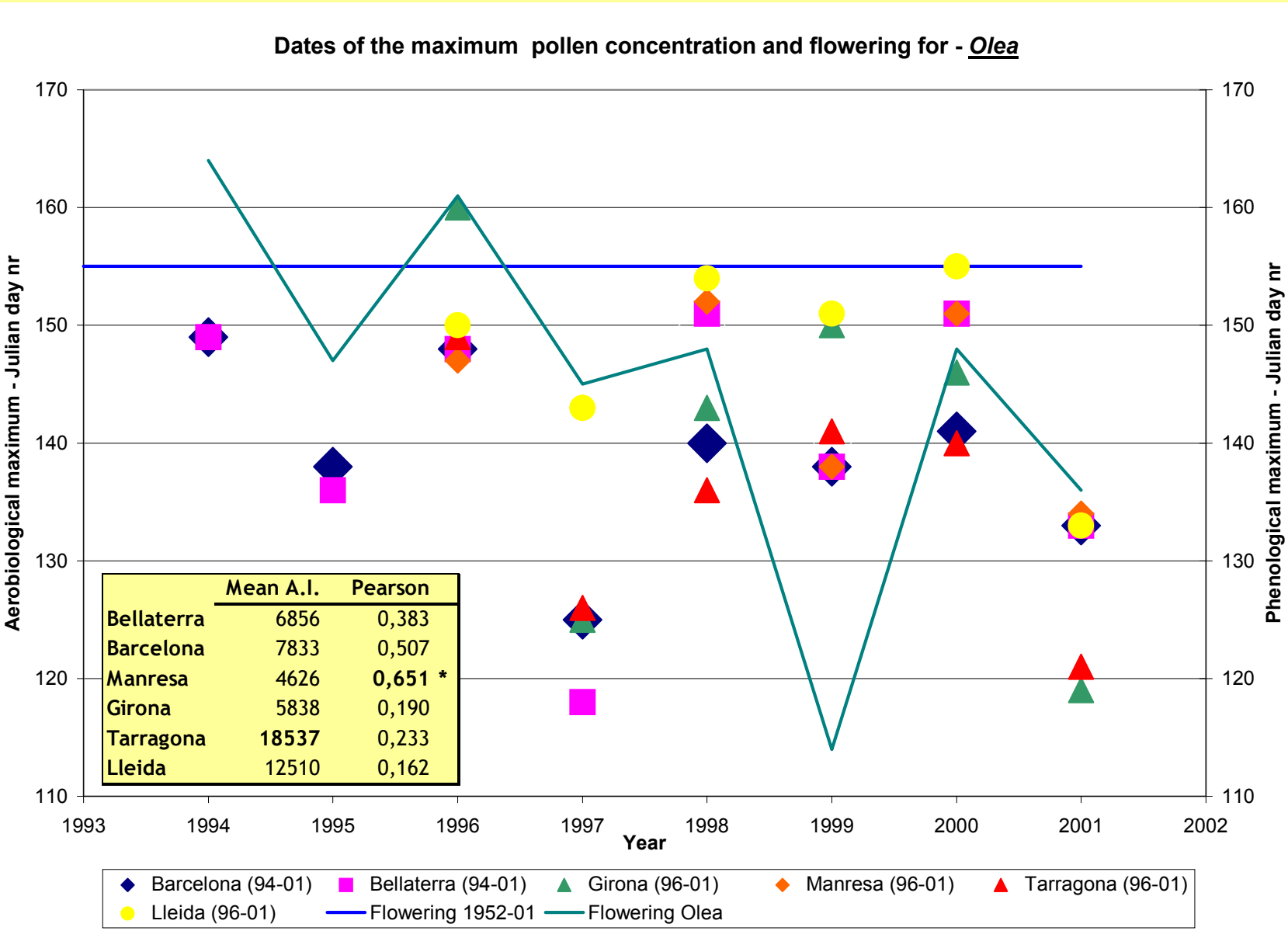

Castanea
220
200
180
160
140
120
100
mean pollen maximum - Julian dates
flowering maximum - Julian dates
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Year
Aerobiological dates
Phenological dates

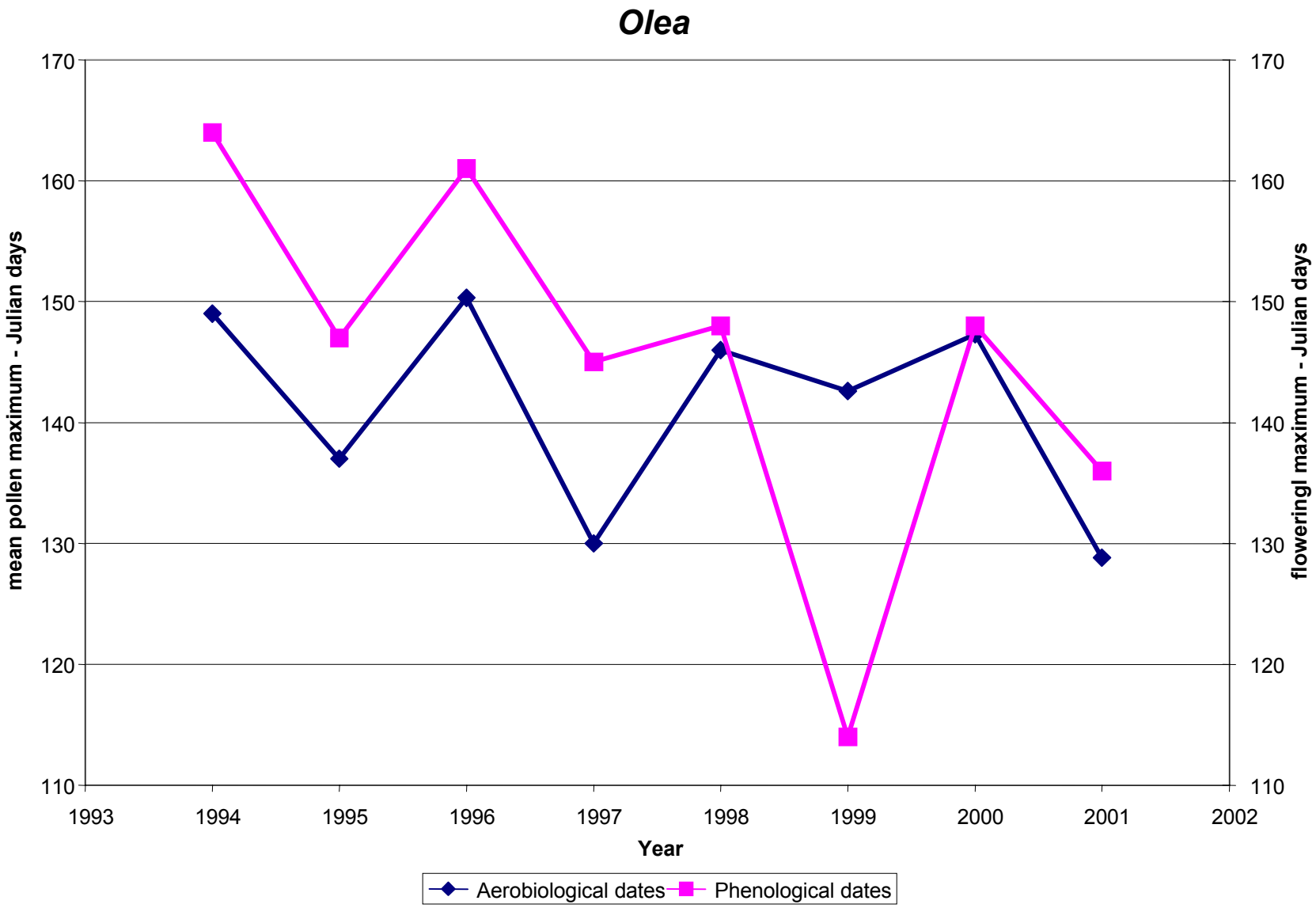
Dates of the maximum pollen concentration and flowering for Fraxinus



	Mean A.I.	Pearson
Bellaterra	1807	0,702 *
Barcelona	1660	0,921 **
Manresa	2666	0,406
Girona	18886	0,430
Tarragona	1814	0,629
Lleida	2021	0,569

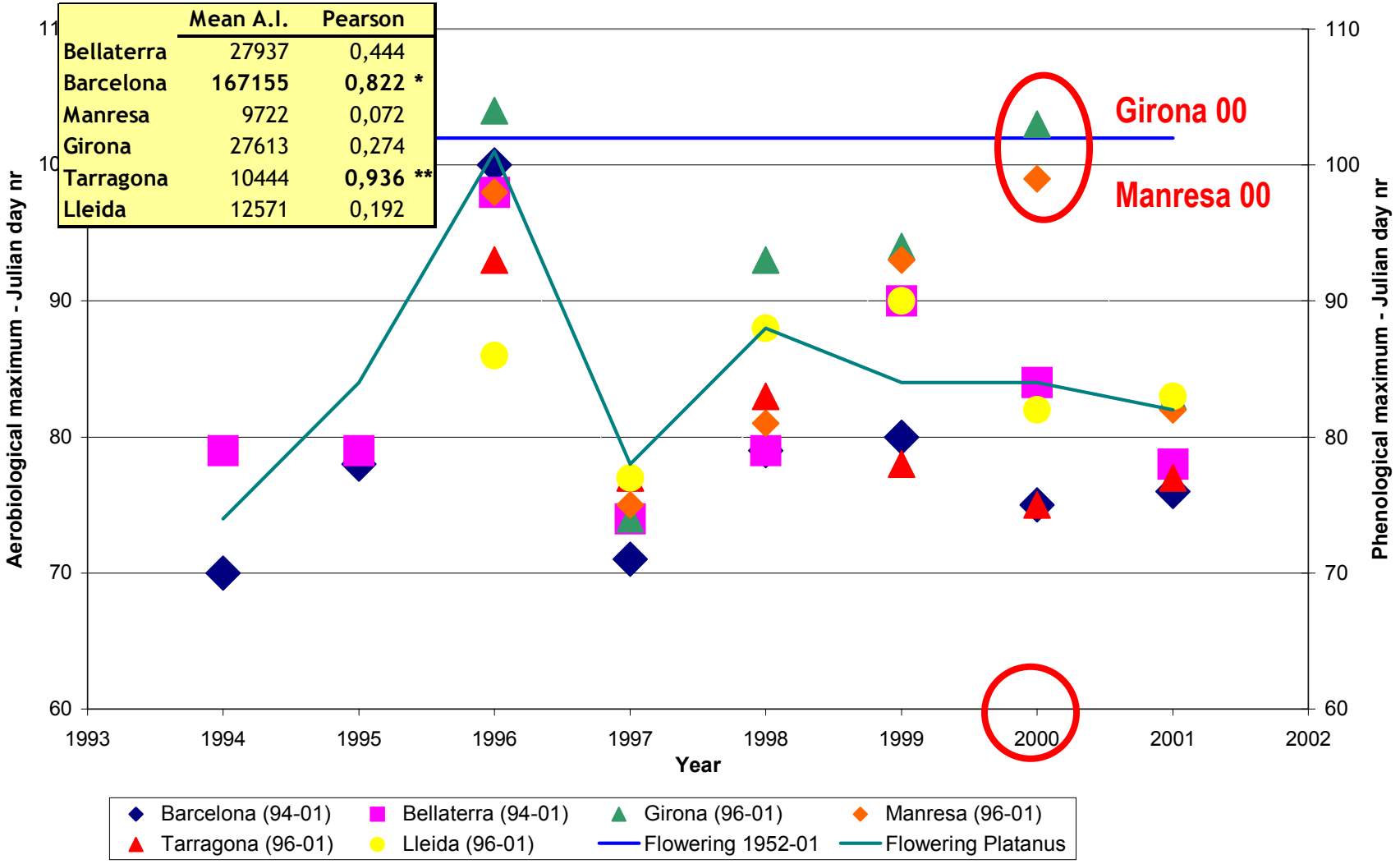

Fraxinus
mean pollen maximum - Julian dates
flowering maximum - Julian dates
0
20
40
60
80
100
120
140
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Year
Aerobiological dates
Phenological dates

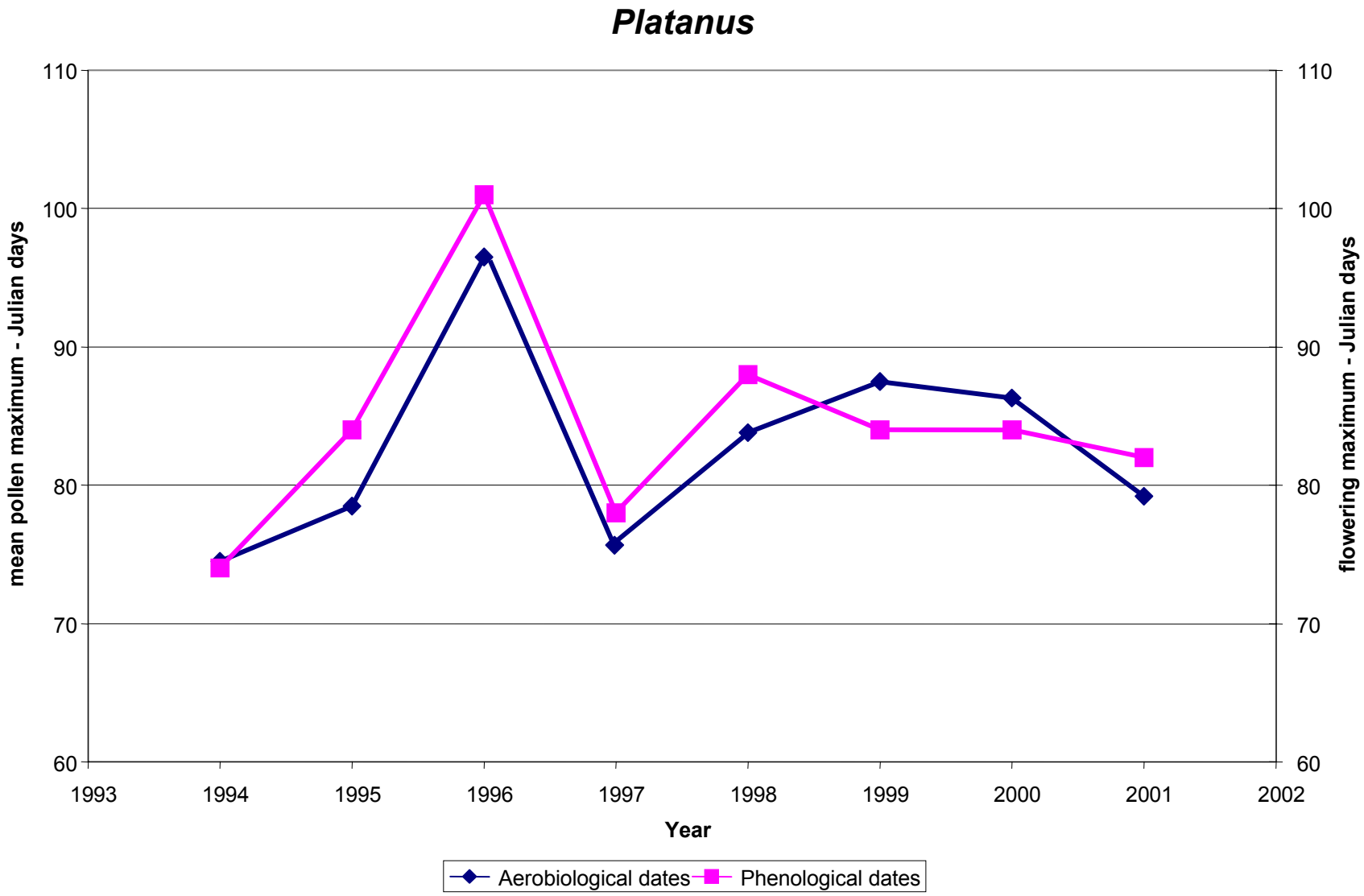

Dates of the maximum pollen concentration and flowering for - Olea
Aerobiological maximum - Julian day nr
Phenological maximum - Julian day nr
Year
170
160
150
140
130
120
110
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Mean A.I. Pearson
Bellaterra 6856 0,383
Barcelona 7833 0,507
Manresa 4626 0,651 *
Girona 5838 0,190
Tarragona 18537 0,233
Lleida 12510 0,162
Barcelona (94-01)
Bellaterra (94-01)
Girona (96-01)
Manresa (96-01)
Tarragona (96-01)
Lleida (96-01)
Flowering 1952-01
Flowering Olea


Olea
170
160
150
140
130
120
110
mean pollen maximum - Julian days
flowering maximum - Julian days
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Year
Aerobiological dates
Phenological dates

Dates of the maximum pollen concentration and flowering for - ***Platanus***

	Mean A.I.	Pearson
Bellaterra	27937	0,444
Barcelona	**167155**	**0,822** *
Manresa	9722	0,072
Girona	27613	0,274
Tarragona	10444	**0,936** **
Lleida	12571	0,192




Platanus
110
100
90
80
70
60
mean pollen maximum - Julian days
flowering maximum - Julian days
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Year
Aerobiological dates
Phenological dates

CONCLUSIONS

- In our study, the relationship between the **Julian day number corresponding to the aerobiological peak** (maximum mean daily pollen concentration in the year) and the **Julian day of maximum flowering observed phenologically**:
  - is **very weak**
  - is **statistically significant** only for **5 taxa (**out of the 17 analysed)
  - is **statistically significant** only for **4 aerobiological monitoring stations** (out of the 6 XAC stations)
  - has no predicting consequences
- It should be interesting to obtain aerobiological and phenological at a single site
- Future analyses will take into account other phenological (fruiting) and aerobiological (beginning pollination periods, pollination intensity) variables
- Phenological stations should incorporate sighting plants producing allergenic pollen such as: Chenopodiaceae-Amaranthaceae, *Plantago*, *Populus*, *Ulmus* or *Urticaceae*

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