

## Chapter S1. Allergenic pollen and spore taxa in this study

In this paper, the most significant allergenic taxa in central Italy were considered: Asteraceae, Betulaceae, Corylaceae, Cupressaceae/Taxaceae, Poaceae, Oleaceae, Urticaceae and *Alternaria* spores.

The classification system of plant species based on morphological criteria, while remaining valid and used, has been supported for almost thirty years now by systematics on a molecular basis [11,12].

The main characteristics of the analyzed taxa are described below [13]:

Asteraceae is a family which includes about 20,000 species, many of which are spontaneous and mostly herbaceous, but some also have a shrub habitus. The characteristic element of this family is the flower head inflorescences, which together simulate a single flower. The flower heads can be carried individually at the end of a bare scape or be gathered in panicle or corymb inflorescences. Pollination of this family is entomophilous with the exception of the genera *Ambrosia* and *Artemisia*, which for this reason, are of considerable aerobiological and allergological interest.

Highly allergenic genera belong to the Asteraceae family, and the pollen season in Italy runs from July to September.

Betulaceae is a family that includes trees and shrubs typical of temperate and cold areas. The Betulaceae are a family belonging to the order of the Fagales, a classification also confirmed by the recent APG classification, according to which two subfamilies are recognized within the Betulaceae: the subfamily Betuloideae, to which the genus *Alnus* (alder) and the genus *Betula* (birch) belong for a total of about 60 species, and the subfamily Coryloideae, which includes the genera *Carpinus* (hornbeam), *Corylus* (hazelnut) and *Ostrya* (black hornbeam) for a total of about 50 species. The genera included in the Coryloideae subfamily belonged, in the past, to the Corylaceae family, which is a family that is still mentioned in the pollen bulletins, and thus, was used in this paper to avoid any confusion in regard to allergic subjects [14–16]. Genera with high allergenicity belong to the Betulaceae family, and the pollen season in Italy runs from December to May.

Cupressaceae and Taxaceae are two botanical taxa whose concentrations are counted together in aerobiological monitoring. In total, 113 species grouped into 12 genera belong to the Cupressaceae family. These are both native and non-native plants, used for ornamental, landscaping or production purposes. Resistant to drought and adaptable to any type of terrain, the Cupressaceae live at sea level and up to 700-800 m. Four genera belong to the Taxaceae, but in Italy there is only the *Taxus* genus. Highly allergenic genera belong to the Cupressaceae family, and the pollen season in Italy runs from December to May.

Poaceae is a widespread family in Italy that includes more than 120 genera and 400 species. These are herbaceous plants that are annual or perennial with cylindrical stems, articulated and empty internodes, simple, alternate leaves, and a sheath that embraces the stem. The flowers are gathered in panicles or terminal spikes. Belonging to the Poaceae family are genera of cultivated (cereals) and spontaneous plants, which are sometimes infesting plants. Highly allergenic genera belong to the Poaceae family, and the pollen season in Italy runs from March to October.

Oleaceae is a family to which belong species that live in temperate and subtropical habitats [17]. In many Italian regions, they are present from the plains to the mountains. The genera most represented in the Italian flora are the genus *Fraxinus* and the genus *Olea*. Generally, highly allergenic genera belong to the Oleaceae family, and the pollen season in Italy runs from February to June.

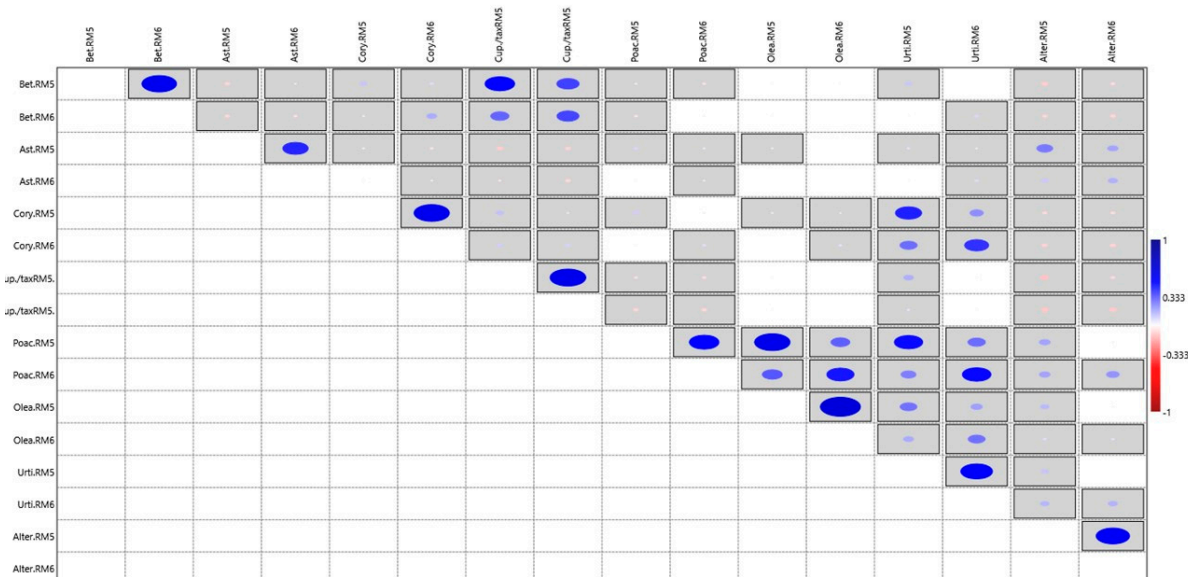
Urticaceae is a family which includes species spread all over the world, but they are especially found in humid, tropical regions. In Italy, it is mostly

represented by the genera *Parietaria* and *Urtica*, but *Boehmeria*, *Pilea* and *Soleirola* are also present. *Boehmeria nivea* (L.) Gaudich. species of the genus *Parietaria* produce highly allergenic pollen, to which sensitivity is widespread. This has created a strong interest around this genus and around the family in general from an allergological point of view. In Italy, the pollen season of Urticaceae runs from March to October.

*Alternaria* is the most interesting spore from an allergological point of view; it belongs to the Pleosporaceae family in the Ascomycetes division. It is capable of causing serious allergic reactions, such as rhinoconjunctivitis and even severe asthma. The diffusion of *Alternaria* spores occurs mainly in summer and autumn, when the higher relative humidity determines favorable conditions for the growth of the mycelium. However, dry air and low wind conditions favor their dispersion. In Italy, the *Alternaria* sporulation season runs from May to November.

**Table S1.** Pearson correlation coefficient for pollen and *Alternaria* in Rome (2003–2019).

Taxon/Pollen station		Bet.		Ast.		Cory.		Cup./tax.		Poac.		Olea.		Urti.		Alter.	
		RM5	RM6	RM5	RM6	RM5	RM6	RM5	RM6	RM5	RM6	RM5	RM6	RM5	RM6	RM5	RM6
Betulaceae	RM5	1.00															
	RM6	0.57	1.00														
Asteraceae	RM5	-0.08	-0.08	1.00													
	RM6	-0.03	-0.05	0.42	1.00												
Corylaceae	RM5	0.11	0.04	-0.04	-0.02	1.00											
	RM6	0.07	0.16	-0.05	-0.03	0.58	1.00										
Cupressaceae /Taxaceae	RM5	0.48	0.30	-0.10	-0.04	0.12	0.09	1.00									
	RM6	0.36	0.36	-0.09	-0.08	0.03	0.08	0.58	1.00								
Poaceae	RM5	-0.04	-0.05	0.08	-0.01	0.10	0.02	-0.06	-0.08	1.00							
	RM6	-0.05	-0.03	0.04	0.04	0.03	0.06	-0.06	-0.08	0.48	1.00						
Oleaceae	RM5	-0.01	-0.02	0.04	-0.01	0.03	0.00	-0.01	-0.02	0.58	0.33	1.00					
	RM6	-0.02	0.01	0.00	0.01	0.03	0.05	0.00	0.00	0.31	0.44	0.65	1.00				
Urticaceae	RM5	0.11	0.01	0.06	0.01	0.43	0.28	0.16	0.04	0.46	0.25	0.27	0.16	1.00			
	RM6	0.00	0.07	0.04	0.06	0.22	0.39	0.02	0.01	0.28	0.47	0.19	0.28	0.52	1.00		
Alternaria	RM5	-0.10	-0.07	0.26	0.10	-0.07	-0.08	-0.12	-0.11	0.18	0.18	0.13	0.06	0.11	0.14	1.00	
	RM6	-0.07	-0.08	0.17	0.15	-0.07	-0.09	-0.07	-0.11	0.03	0.21	0.02	0.05	0.00	0.15	0.55	1.00



**Figure S1.** Pearson correlation plot for pollen and *Alternaria* in Rome (2003–2019); significance of  $p < 0.05$ , boxed.