

The first approach towards recognising allergy-provoking flora in Belluno and its relationship with allergic phenomena

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SUMMARY. *The town of Belluno has a high number of wild and cultivated plants whose pollen has various degrees of importance from an allergological point of view.*

In this preliminary study we have taken into consideration the distribution and the flowering period of these species, correlating them with the data on the quantity and type of pollen collected by a sampler placed on the roof of the City Hospital, and also with the results of the allergometric tests (Prick Tests) carried out in the Broncho-Pneumological Department during the first 9 months of 1990.

The wild species of spring-flowering trees which can be found in the woods surrounding the city (Fagaceae, Betulaceae, Corylaceae) and along the gravel banks of the Piave river (Salicaceae) as well as the Graminaceae which are widespread both in the urban area and in the fields outside the city and some cultivated species (Robinia, Tilia, Acer) which flower a little later, are the species which produce most pollen and which are held responsible for allergies. However, only the pollen of the Graminaceae gave rise to cases of mono-sensitivity (16%) (apart from one case of Betulaceae and Corylaceae and one case of Artemisia as well as Dermatophagoides) (9.7%). For the other species, the positive reactions were associated with the positive reactions to the pollen of other species belonging to different families and/or to other factors.

Key words: *Spontaneous and cultivated flora, phenology, airborne pollen, pollinosis.*

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The town of Belluno, situated in a wide valley called «la Val Belluna», rises on the right-hand side of the River Plate and is surrounded to the north by the Dolomites (mount Schiara, mount Serva) and to the south by a chain of hills (Nevegal, Col Visentin).

The flora, both spontaneous and cultivated, in the urban area is rather rich and complex and, on the whole, it is concentrated in parks and gardens or distributed along the road-sides and in the squares. There is also a considerable amount, mainly unnoticed, of weeds and ruderal and anthropophilic species scattered almost everywhere, but above all along the borders of many roads and avenues, in flower-beds, on the walls of old buildings, on the walls of houses and in all abandoned areas.

The most common species of trees and shrubs are conifers and broadleaf trees, while the most predominant grasses are Graminaceae and Compositae; we did not take into consideration the vast number of annuals, or those treated as such, that decorate vases and gardens and that vary from season to season and from year to year according to the plant nursery fashions of the moment. The areas which immediately border the city centre are made up of meadows, both sterile and fertilized, and mesophilic woods.

In the years 1989-90, approximately 180 species were counted on occasion of a census taking, among which 58 species were considered as allergy provoking, above all due to their production of an extremely sensitizing pollen.

We have, therefore, tried to highlight in what way and in what quantities the composition of spontaneous or cultivated *flora urbana* may influence this phenomenology, both by means of data obtained by reading slides of airborne pollen and by means of the results of allergometric tests.

Allergy provoking *Flora urbana*

The species noted in the census as being responsible for allergies follow herewith according to the order used by Pignatti in «Flora d'Italia» (1982). For each species we have indicated: the zone it most commonly populates in the area covered by the census, biological form, flowering period, spontaneous origin (spont.) or introduced origin (cult.) and its diffusion (r.=rare, c.=common, ab.=abundant, v. ab.=very abundant).

The biological forms considered are: T rept=*Therophyta reptans*; G rhiz=*Geophyta rhizomatosa*; H caesp=*Emicryptophyta caespitosa*; H ros=*Rosulata*; P caesp=*Phanerophyta caespitosa*; P scap=*P. scaposa*; P lian=*P. lianosa*; P rept=*P. reptans*.

As far as the locations are concerned, the area considered has been subdivided into various sub-areas, each marked with a letter of the alphabet; to be more precise, from A to L for the urban areas and M for the surrounding areas (Fig. 1): A=via Feltre, via Cavour, via Caffi, via Segato; B=Piazza dei Martiri (square); C=Station; D=Parco, Città di Bologna (Park); E=Hospital; F=Piana di Lambioi, via Sottocastello; G=Parco di Mussoi (Park); H=Ponte degli Alpini (Bridge); I=via Giovanni Paolo I and surrounding area; L=via Vittorio Veneto, via Alpago Novello and adjacent areas; M=South-western entrance to the city.

Floristic list

Pinaceae:

Picea excelsa (Lam.) Link; A E F G H I L M; P (scap); V; spont.-cult; c.

Pinus nigra Arnold; A D E G; P (scap); V; cult.; c.

Pinus sylvestris L.; I M; P (scap); IV-V; cult.-spont.; c.

Pinus mugo Turra; E F I; P (rept); V; cult.; c.

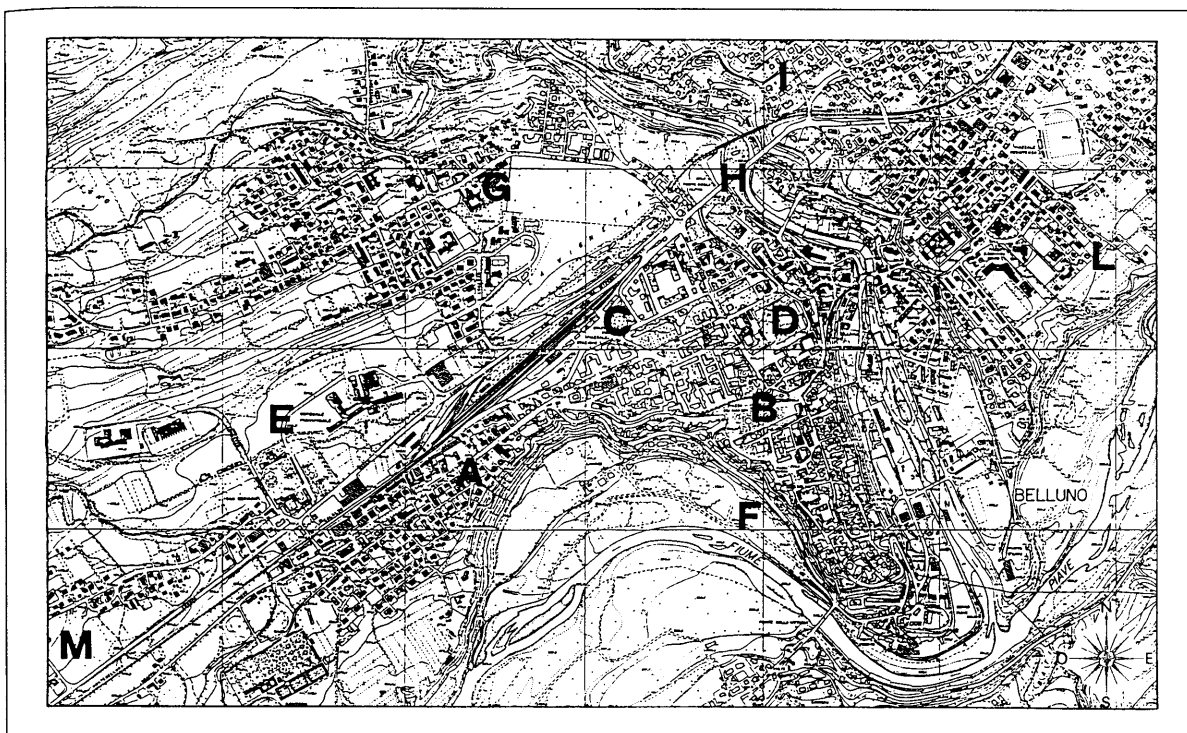


Figure 1. Map of Belluno; A - M: areas studied.

Cupressaceae:

Cedrus deodara G. Don; D I L; P (scap); V; cult.; c.

Cedrus libani A. Richard; B C D L; P (scap); cult.; c.

Cupressus sempervirens L.; B E I; P (scap); II-IV; cult., c.

Cupressus arizonica Green; D L; P (scap); V; cult.; c.

Chamaecyparis lawsoniana Murray; A B D I L M; P (scap); IV-V; cult.; c.

Thuja occidentalis L.; B D G L; P (caesp); IV-V; cult.; c.

Thuja orientalis L.; B L; P (caesp); IV-V; cult.; c.

Salicaceae:

Salix sp. pl.; A E F G I M; P; III-V; spont.; ab.

Populus alba L.; F G H L; P (scap); II-IV; spont.; c.

Populus tremula L.; E H L; P (scap); IV-V; spont.-cult.; c.

Populus nigra L.; G H; P (scap); IV-V; cult.; c.

Juglandaceae:

Juglans regia L.; F; P (scap); IV-V; cult., c.

Betulaceae:

Betula pendula Roth; A D E G H I L; P (scap); II-V; cult.; ab.

Betula pubescens Ehrt.; M; P (scap); III-V; cult.; ab.

Alnus glutinosa (L.) Gaertner; M; P (scap); IV-V; spont.; c.

Alnus incana (L.) Moench.; G; P (scap); IV-V; spont.; c.

Corylaceae:

Carpinus betulus L.; G H L; P (scap); III-V; spont.; c.

Ostrya carpinifolia L.; E I; P (scap); III-IV; spont.; c.

Corylus avellana L.; A L G I M; P (caesp); II-V; spont.; v. ab.

Fagaceae:

Fagus sylvatica L.; E G M; P (scap); III-V; spont.; v. ab.

Castanea sativa Miller; M; P (scap); V-VIII; spont. cult.; c.

Quercus robur L.; E L G; P (scap); IV-V; spont.; c.

Quercus pubescens Willd.; G M; P (caesp); IV-V; spont.; c.

Ulmaceae:

Ulmus glabra Hudson; G; P (scap); III-IV; spont.; c.

Ulmus minor Miller; E; P (scap); III-V; spont.; c.

Cannabaceae:

Humulus lupulus L.; E M; P (lian); VI-VII; spont.; c.

Urticaceae:

Parietaria officinalis L.; E G; H (scap); IV-IX; spont.; c.

Chenopodiaceae:

Chenopodium album L.; E; T (scap); VI-VIII; spont.; c.

Leguminosae:

Robinia pseudoacacia L.; B C E F G H I L M; P (caesp); VI-VII; spont.; ab.

Hippocastanaceae:

Aesculus hippocastanum L.; A D E F G L M; P (caesp); V; cult.; ab.

Tiliaceae:

Tilia sp. pl.; A D E F I L, P (scap); VI-IX; cult. ab.

Oleaceae:

Fraxinus ornus L.; A B F G M; P (scap); III-V; spont.; ab.

Fraxinus excelsior L.; E L; P (scap); IV-V; spont.; ab.

Compositae:

Artemisia vulgaris L.; E M; H (caesp); VII-IX; spont.; c.

Artemisia absinthium L.; M; H (caesp); VIII-IX; spont.; c.

Plantaginaceae:

Plantago lanceolata L.; C D E F; H (ros); IV-IX; spont.; c.

Aceraceae:

Acer campestre L.; E G L; P (scap); IV; spont.; c.

Acer negundo L.; G; P (scap); IV; colt.; c.

Acer pseudoplatanus L.; C F G L; P (caesp); IV; spont. cult.; c.

Graminaceae:

Cynosurus cristatus L.; M; H (caesp); VII-VIII; spont.; c.

Briza media L.; E M; H (caesp); V-VI; spont.; ab.

Poa annua L.; D E M; H (caesp); IV-IX; spont.; v. ab.

Poa pratensis L.; A E F M; H (caesp); IV-IX; spont.; v. ab.

Dactylis glomerata L.; A C E F G M; H (caesp); IV-IX; spont.; ab.

Festuca altissima All.; M; H (caesp); V-IX; spont.; ab.

Festuca pratensis Hudson; M; H (caesp); V-IX; ab.

Lolium perenne L.; D M; H (caesp); V-IX; spont.; ab.

Bromus erectus Hudson; E G M; H (caesp); V-IX; spont.; ab.

Agropyrum repens Beauv.; M; G (rhiz); VII-VIII; spont.; c.

Avena fatua L.; E M; T (scap); V-VI; spont.; c.

Hoicus lanatus L.; M; H (caesp); V-VII; spont.; ab.

Calamagrostis varia Host; G M; H (caesp); VI-VII; spont.; c.

Antoxantum odoratum L.; E M; H (caesp); IV-VIII; spont.; ab.

Phleum pratense L.; L M; H (caesp); V-VIII; spont.; c.

Cynodon dactylon Pers.; E; G (rhiz); V-IX; c.

The composition of the urban vegetation is extremely varied. As far as trees and shrubs are concerned, Cupressaceae and Pinaceae are rather common and widespread in parks and gardens, together with *Betula pendula* Roth, while various species of *Tilia* and *Aesculus hippocastanum* L. can be found lining the avenues.

In the areas just outside the city, *Fagus sylvatica* L., *Ostrya carpinifolia* L., *Carpinus betulus* L. and *Corylus avellana* L., are widespread, while various species of willow (*Salix* sp. pl.) can be found on the banks of the river Piave in particular and also around the hospital.

The Gramineae, among which *Dactylis glomerata* L., *Poa annua* L., *Poa pratensis* L., *Lolium perenne* L., *Bromus erectus* Hudson. *Antoxantum odoratum* L. and *Festuca pratensis* L., are the most common grasses. They are widespread both in the meadows on the outskirts of the city as well as in the large number of cultivated areas within the city (gardens, flower beds, borders lining the pavements and roads). In addition they can be found in many areas where there are ruins.

Other common species are the *Artemisia* (*Artemisia vulgaris* L., *Artemisia absinthium* L.), *Chenopodium album* L. and *Plantago lanceolata* L. in all the areas where there are ruins.

Airborne Pollen

The observations of airborne pollen with the help of an optical microscope, confirmed the more or less abundant presence of pollen grains in the atmosphere. These pollen came from al-

lergy-provoking species as well as obviously non allergy-provoking species also in their flowering period (Feliziani, 1986).

The pollen was monitored by means of a weekly, volumetric sampler (Hirst type, Burkard) placed on the roof of the City Hospital of Belluno at a height of 25 m above ground level and having a flow rate of 10 l/m. The possibility of quickly reading the slides, the preparation method, the type of allergometric tests used and the fact that the grain morphology often characterised a genus or a family rather than a single species, led us to record primarily the daily number of pollen grains over an eight-month period.

On the 176 slides obtained, we were able to identify the grains of a large number of trees which normally flower in spring (from February to May): Betulaceae, Corylaceae, Cupressaceae, *Populus* sp. pl., Salicaceae, *Fraxinus* sp. pl., Ulmaceae and Fagaceae and of a second, much lower number of grasses which have a longer (or repeated) flowering period, which, however, flower in summer: Gramineae, Urticaceae, Plantaginaceae, to which we can add *Castanea sativa* Miller and a group which has a decidedly late-summer flowering period: Compositae and *Humulus lupulus* L. (Fig. 2).

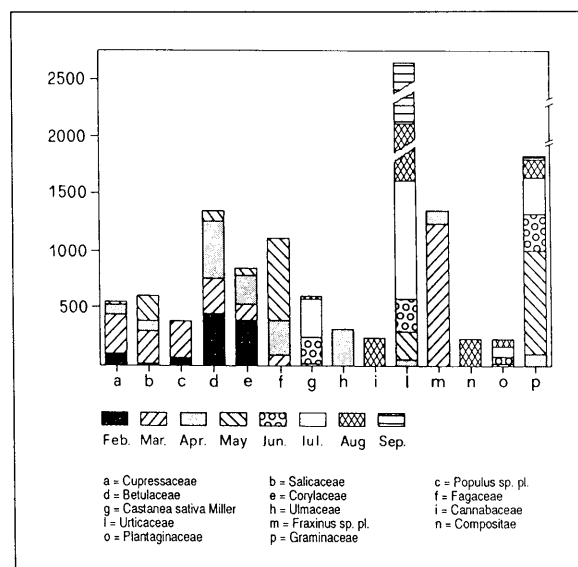


Figure 2. Total number of pollen grains collected from February (2) to September (9).

The number of pollen grains of each category present on the slides varies a great deal according to the period taken into account and even from one day to the other; this is both related to the flowering period and to the number of individuals which flower; the physical, climatic and microclimatic factors of the environment in which the various species grow are very important: temperature, exposure, air currents, wind, humidity, dew, rain, etc. It would be useful to correlate and interpret all this data (Figs. 3, 4).

The grains of some of these families are con-

stantly present, even if in small quantities; others, on the other hand, are more discontinuous but present, at times, in larger quantities and with peaks as follows:

Compositae: 100; 21-9-1990.

Cupressaceae: 127; 27-2-1990.

Graminaceae: 142; 4-5-1990.

Corylaceae: 116; 27-3-1990.

Betulaceae: 235; 15-2-1990.

Fagaceae: 240; 4-5-1990.

Salicaceae: 350; 21-3-1990.

Urticaceae: 403; 3-8-1990.

Fraxinus sp. pl.: 613; 20-3-1990.

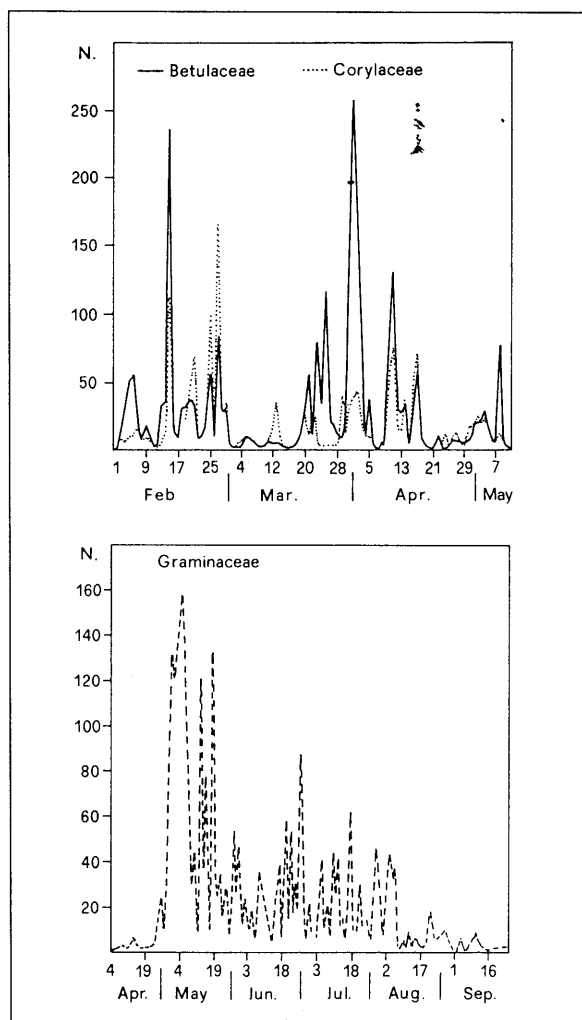


Figure 3. Daily variation in the number of grains of the selected pollen taxa in the first decade of May (5) and the second decade of July (7).

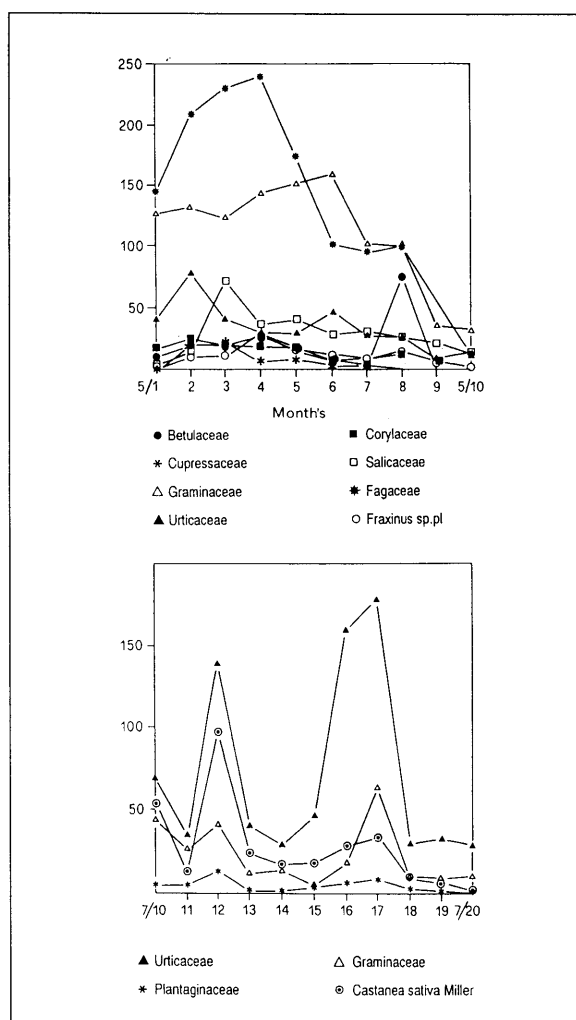


Figure 4. Daily variations in the pollen concentration of Betulaceae, Corylaceae from 1st February to 7th May and Graminaceae from 4th April to 16th September.

Allergies

The techniques used to recognize allergies is based on the cutaneous test called Prick test. During the first 9 months of 1990, 151 citizens of Belluno, mostly affected by rhino-conjunctivitis (Senargiotto *et al.*, 1990), underwent allergometric tests at the City Hospital: 48 (31 females and 17 males) had negative results, while 102 showed positivity to some of the mixes (Italian Bayropharm) used, in particular 11 species caused sensitivity, namely:

1. Graminaceae (*Holcus lanatus* L., *Poa pratensis* L., *Lolium perenne* L., *Dactylis glomerata* L., *Cynodon dactylon* Pers.);
 7. Pinaceae, Cupressaceae;
 8. *Fagus* L., *Fraxinus* L., *Quercus* L., *Platanus* L.;
 9. *Betula* L., *Corylus* L., *Ulmus* L., *Alnus* L., *Populus* L.;
 10. *Robinia* L., *Tilia* L., *Acer* L., *Aesculus* L.;
 107. *Parietaria officinalis* L.;
 143. *Artemisia* L.;
 166. *Plantago lanceolata* L.;
 306. Epidermic derivatives (some drops of mix 307 and 390 have been added to this mix).
 308. *Dermatophagoides* (*D. pteronyssinus*, *D. farinae*);
 309. House dust
- (the number is that of the mix used) (Tab. I).

Among those people who resulted positive, 35% were found to be allergic to the pollen of one or more plants or families, 30% were found to be allergic to other factors (*Dermatophagoides* and/or dust and epithelium deposits) and another 35% were found to have mixed allergies (Fig. 5).

Furthermore, a certain percentage of the subjects were sensitive to only one (27%) or two (30%) of the indicated mixes; however, the cases of positive sensitivity to 3 or 4 mixes is quite frequent; there are fewer cases sensitive to 5, 6 or 7 mixes and only one case was sensitive to 10 mixes (Fig. 6). Out of the people examined, 270 positive cutaneous reactions were observed.

Table I. Number of the mixes, corresponding families and genera, flowering period and number of positive cutaneous reactions.

Mix	Taxa	Anthesis	N. P-Grains	N. S
1	Fam.: Graminaceae	III-IX	3652	60
7	Fam.: Pinaceae	IV-V		3
	Fam.: Cupressaceae	II-V	1099	
8	Fam.: Fagaceae			21
	gen.: <i>Castanea</i> Miller	V-VIII	1186	
	ge.: <i>Fagus</i> L.	III-V	2223	
	Fam.: Oleaceae			
	gen.: <i>Fraxinus</i> L.	III-V	2692	
9	Fam.: Salicaceae			25
	gen.: <i>Salix</i> L.	III-V	1209	
	gen.: <i>Populus</i> L.	II-V	725	
	Fam.: Betulaceae	II-V	2688	
	Fam.: Corylaceae	III-IV	1695	
	Fam.: Ulmaceae	III-IV	601	
10	Fam.: Leguminose			21
	gen.: <i>Robinia</i> L.	IV-VII		
	Fam.: Tiliaceae	VI-IX		
	Fam.: Aceraceae	IV		
	Fam.: Hippocastanaceae	V		
107	Fam.: Urticaceae			4
	gen.: <i>Parietaria</i> L.	IV-IX	9141	
143	Fam.: Compositae			13
	gen.: <i>Artemisia</i> L.	VII-IX	460	
166	Fam.: Plantaginaceae			
	gen.: <i>Plantago</i> L.	IV-IX	455	
6	Fam.: Cannabaceae			
	gen.: <i>Humulus</i> L.	VI-IX	475	
306	Epidermic derivatives			11
308	<i>Dermatophagoides</i>			62
309	House dust			50

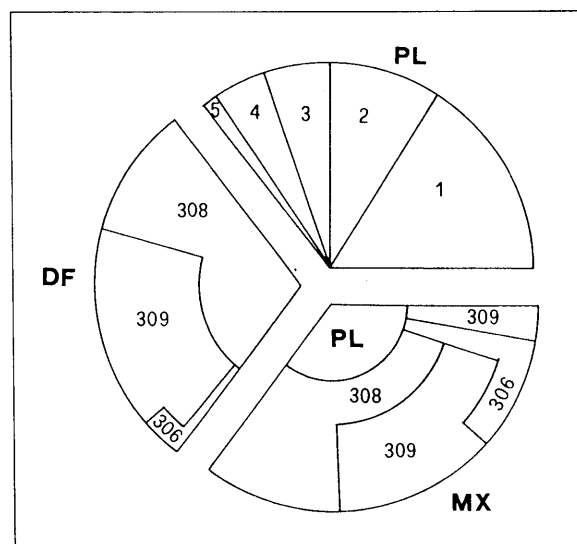


Figure 5. The percentage of subjects affected by pollenosis (PL) towards 1, 2, 3, 4, 5 of the used mixed. Allergies to other factors (DF) indicated by the number of the respective mixes. Allergies (MX) to pollen (PL) and to 1, 2 or 3 other factors, indicated by the number of the mix.

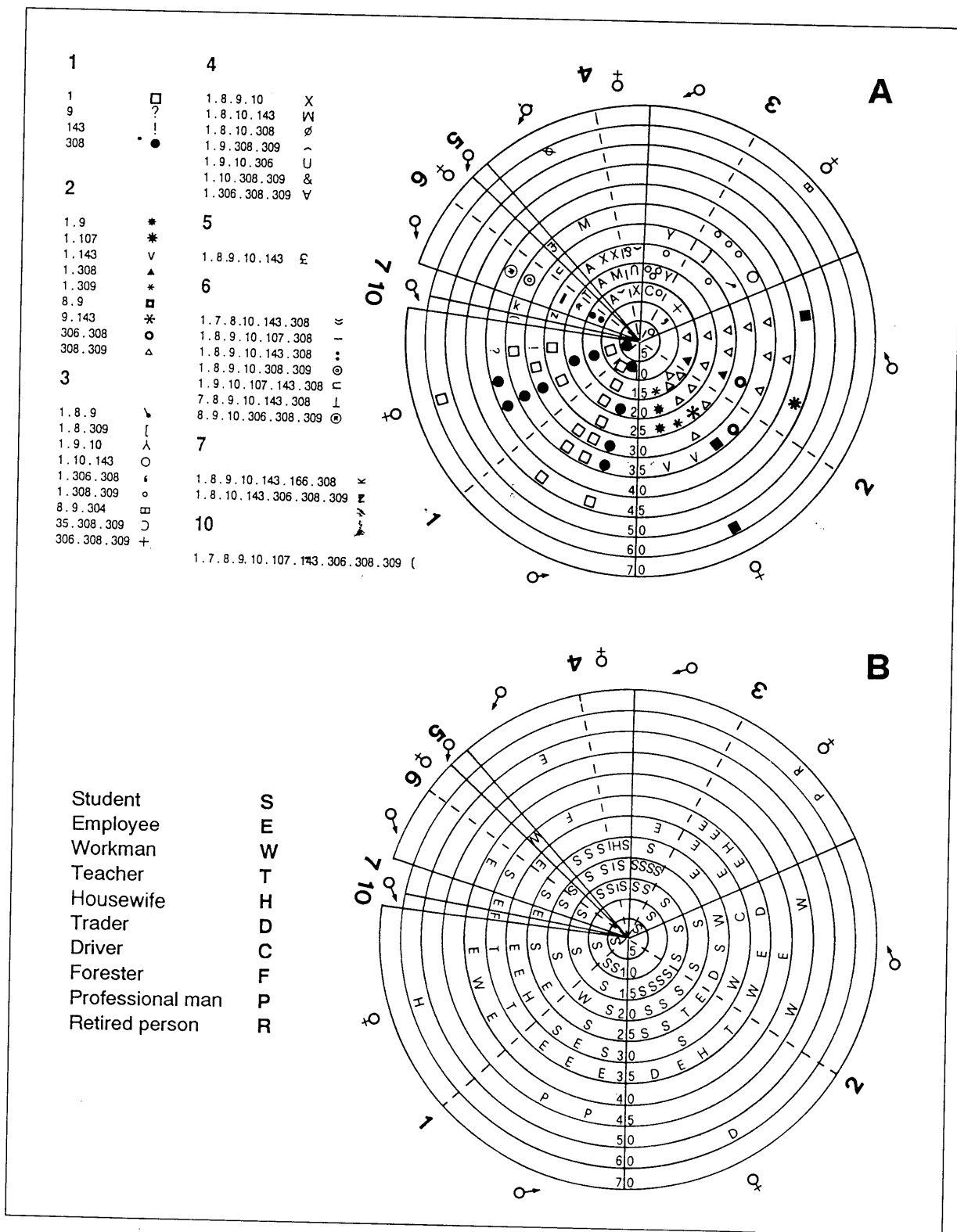


Figure 6. Number and type of positive cutaneous reactions to mixes in relation to age, sex (A) and profession (B) of the allergic subjects.

The data examined revealed that Graminaee (Mix 1) and *Dermatophagoides* (Mix 308) were the major causes of positive cutaneous reactions, either alone or together and also together with other factors; in particular, allergies to the pollen of the Graminaceae often tend to be associated with the pollen of plants belonging to other families and very often to those present in Mix 8 (*Fagus*, etc.), Mix 9 (*Betula*, *Corylus* etc.) and Mix 10 (*Tilia*, *Acacia*, etc.), while allergies to the *Dermatophagoides* tend to be associated with house dust.

However, in case of poly-sensitivity to more than one factor (3, or more) very often there is a mixed allergy (45% of the subjects), while that to *Dermatophagoides* and two, or more, types of pollen affects 17% of the subjects.

Among the people who resulted positive, males are more numerous (53%) than females. This is the case with poly-sensitization to more than three mixes, while in the cases of a sensitization to 1, 2, or 3 mixes, the number of males tends to be the same as females, or even a little lower. Females are more numerous only in the case of sensitization to the pollen of two mixes.

The fact that the most of the people who resulted positive to the tests (53%) are less than 25 years old explains the higher percentage of students among the allergic subjects and underlines the diffusion of this illness among young people (Fig. 6).

CONCLUSIONS

Among the subjects who had positive cutaneous reactions to the allergometric tests, 67 were sensitive to the pollen of one or more families, with an overall total of 147 positive responses; in addition, 37 of these subjects were allergic to pollen alone.

Pollinosis seems to have a negative influence on some people, and is likely to limit their performance, especially in late spring and early summer.

The local flora is, therefore, of great significance as far as the onset and duration of these phenomena are concerned.

The widespread species of Graminaceae, which are commonly found both in the urban flora, where they colonize all ruderal and uncultivated areas and are often a fundamental element of public and private green areas as well as the fields on the outskirts of the city, proved to be chiefly responsible for this situation.

However, Fagaceae, Betulaceae and Corylaceae, which are an essential component of the surrounding woodlands, and Salicaceae, which are very widespread in the areas along the Piave river, cause a large number of allergies as well which are, on the whole, never due to their pollen alone but to their pollen together with other factors (both other pollen or other factors). Even the pollen of some trees such as *Robinia* L., *Tilia* L., *Acer* L. and *Aesculus* L., which are frequently cultivated in the urban area, cause allergic reactions in subjects suffering from poly-sensitivity.

It is therefore evident that both the wild flora growing in the natural environment in which the city has developed and which penetrates inside the city wherever it finds the right conditions, as well as the flora which is introduced into the city in order to enrich urban green areas, influence the activities of many people since they cause allergic syndromes.

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