Is Blending the Graminean Allergens a Reliable Practice?

An Evaluation of Blending Graminean Allergens*

Michel Filou, M.D., Ph.D.
Francois X. Lebas, M.D.
Jacques Malbos, M.D.
Isabelle Alemany, M.D.

The *Gramineae* family is composed of many species, the taxonomy of which is ruled not only by classic criteria of external morphology but also mainly by the following:

– Internal anatomy of the leaf;
– Basic number of chromosomes;
– Pattern of the embryo; and most important for our purpose,
– Photosynthetic pathway; and
– Crossed antigenicity.

According to Heywood,[1] the *Gramineae* family is divided into six subfamilies. Only three of them are important in France. *Pooïdeae,* which is widespread throughout the country, is the major one. *Panicoïdeae* has some importance in the warmest parts of the country. It is now increasing with the culture in seashore areas of *Zea Maïs. Chlorodoïdeae* is also restricted to some coastal areas. *Bambusoïdeae* and *Centostecoïdeae* are found in warm countries. The *Arundinoïdeae* grow better in relatively warm climates.

In France, Braun-Blanquet,[2] Bournerias[3] and many others[4-6] have studied plant communities. In Tables 1-5, we report on the most common species found in the *Graminean* communities. Table 6 displays those plants reported by Lahondere.[6]

Table 1 Meadow grasses

Wet meadows (n = 7)		Normal meadows (n = 8)		Dry meadows (n = 4)	
Poa trivialis	7	*Poa trivialis*	7	*Festuca* sp.	4
Dactylis glom.	7	*Phleum pratense*	7	*Cynosurus crist.*	3
Lolium perenne	6	*Festuca* sp.	6	*Briza media*	3
Cynosurus crist.	6	*Agrostis vulgaris*	6	*Dactylis glom.*	3
Anthoxanthum odor.	4	*Dactylis glom.*	6	*Bromus erectus*	2
Alopecurus gen.	4	*Arrhenaterum elat.*	5	*Anthoxanthum odor.*	2
d° prat.	3	*Elymus hispidus*	4	*Agrostis vulg.*	1
Agrostis vulg.	2	*Briza media*	3		
Monilia coerulea	1	*Avena pubescens*	1		
		Cynosurus crist.	1		

The number indicates the number of meadows studied, and how many times the species were found.

N.B. All these grasses with the exception of *Monilia coerulea (Arundi noideae)* belong to the *Pooideae* subfamily.

OBSERVATIONS

The composition of pollen extracts distributed by pharmaceutical companies in France is presented in Table 7.

It is interesting to note that the choice of the species composing these extracts has not been left to chance: *Pooïdeae* are represented judiciously and perhaps abundantly by members of each of their main tribes, except for *Triticaceae;* furthermore, the other subfamilies are almost completely absent. Despite

*From the "Allergologie et Immunologie Clinique, Services de Pneumologie" Centre Hospitalier, 194 AV, Rubillard – 72037 LE MANS Cedex, France.

this, clinical observation and the results of specific hyposensitisation show that these extracts offer fairly good results in a very large proportion of patients.

A comparison of the sensitivity of 120 patients to different tribes of *Pooïdeae* is presented in Table 8. All patients had evident hay-fever and positive RAST tests. The patients were divided into classes as follows: positive reactions were designated as +++ class and ++ class; negative reactions as + class and 0 class.

In comparing the effect of *Dactylis* and *Holcus* pollens versus those of *Phleum*, we obtained a Chi-square test result of 1.66, non-significant (5.99; degrees of freedom 2). In matching the first three pollens against Hordeum pollen, the Chi-square test result was 2.32 non-significant (3.84 degree of freedom 1).

Although the two Chi-square tests are not significant, attention must be paid to the difference betweens the two values: if *Poae, Avenea* and *Agrostidae* seem to have a strong cross antigenicity, this could be different if *Triticaceae* were present. We note that one laboratory (Stallergenes) prepares a separate extract for cereal pollens, and that Yman[4] has found a strong IgE-mediated crossed sensitivity between the different *Pooïdeae*, except for the *Triticaceae* (see Table 9).

However, some patients do not recover completely, even when fully treated with the above-mentioned extracts. Clinical features of the disease are always the same: patients, who live in the countryside and who suffer from hay-fever during the pollen season (May and June in France), were treated for one or two years with the aqueous Pasteur extract. Subsequently, they were symptom-free in May and June, but suffered instead at the end of August. Manifestation of the disease increased according to their proximity to *Zea Maïs* fields. The symptoms disappeared completely at the beginning of September and whenever they went to town. Such a reaction is representative of sensitisation to *Zea Maïs;* there is a correlation between the periods when the disease was manifest and the periods when pollen grains of *Z. Mais* were found on slides during pollen counts (heavy pollen grains are not well transported by wind). Four patients (see Table 10) had strong positive reactions when tested with *Z. Maïs* (and other *Panicoideae*) extracts and weak reactions when tested with *Pooïdeae* extracts.[5] The Chi-square test was highly significant (for degree of freedom 1). Specific desensitisation with *Z. Maïs* extracts completely cured these patients.

It is possible that grasses of the

Table 2 Harvest and lawn grasses.

Harvest	Lawns
Triticum sp.	*Agrostis* sp.
Hordeum sp.	*Festuca* sp.
Avena sativa	*Lolium* sp.
Secala sp.	*Poa* sp.
Zea mais	*Cynosurus* sp.

N.B. *Zea Mais* is a *Panicoideae*. All others belong to the *Pooideae*.

Table 3 Fallow and garden grasses.

Fallow (n = 7)		Gardens (n = 5)	
Poa annua	7	*Poa annua*	5
Bromus sterilis	7	*Elymus repens*	3
Elymus repens	5	*Mibora verna*	3
Bromus inermis	4	*Lolium italicum*	2
Bromus tectorum	3	*Festuca* sp.	2
Nardurus sp.	2	*Setaria viridis*	1
Arrhenaterum elatior	1	*Phragmites communis*	1
Arundo donax	1		

Numbers as in Table 1, *Setaria* belongs to the *Panicoïdeae, Phragmites* and *Arundo*, to the *Arundinoideae;* and all others to the *Pooïdeae* subfamily.

Table 4 Alpine meadow grasses.

Altitude < 1,000 m (n = 6)		Altitude < 1,800 m (n = 5)	
Festuca rubra	6	*Festuca violacea*	5
d° violacea	6	*d° Pumila*	5
Phleum alpinum	6	*d° varia*	5
Festuca varia	5	*Poa alpina*	5
Phelum hirsutum	5	*d° minor*	5
Poa supina	5	*d° laxa*	4
Agrostis tenella	4	*d° coesia*	3
Anthoxanthum odoratum	4	*Trisetum spicatum*	3
d° Alpinum	3	*Avena versicolor*	2
Cynosurus cristatus	2	*Agrostis* sp.	1
Lolium sp.	1	*Poa cenisia*	1
Molinia coerulea	1		
Nardus stricta	1		

Numbers as in Table 1. All grassess but *Monilia* belong to *Pooïdeae*.

N.B. 1,800 m marks the border between the subalpine and alpine meadow designation.

Sparitina type (*S. maritima, S. towsendi*) are responsible in other instances, such as those occurring at the end of July, when city-dwellers with a history of hay-fever (but who are healthy after treatment during the period May-June) go to the seashore. Some have been studied and specific sensitisation to the *Chloridoideae* subfamily appears to be possible, but such cases are rare in France, where the *Chloridoïdeae* subfamily is not commonly found (Table 11).

Table 5 Grasses of the Mediterranean region.

Fields (n = 8)		Fallows and Gardens (n = 8)	
Brachypodium ramosum	8	*Bromus sterilis*	5
Poa annua	8	*Setaria verticillata*	4
Poa bulbosa	7	*Arundinaria* sp.	3
Hordeum murinum	6	*Pharagmites communis*	3
Bromus sterilis	4	*Lolium rigidum*	3
Arrhenaterum elatior	2	*Setaria viridis*	2
Melica ciliata	1	*Poa annua*	2
Stipa pennata	1	*Poa trivialis*	2
		Bromus rubens	2
		Phyllostachys nigra	1
		Cynodon dactylon	1

The Mediterranean region has a specific type of vegetation. We found there not only *Pooïdeae*, but also *Panicoideae (Setaria), Bambusoideae (Arundinaria, Phyllostachys), Arundinoideae (Phragmites)* and *Chloridoideae (Cynodon).*

It would be interesting to carry out studies in warmer climates, where *Panicoïdeae* and *Chloridoïdeae* are much more common. If patients in such regions were less (or, perhaps, not) sensitised to *Pooïdeae*, this would mean that the extension of sensitisation to the different members of a botanic (or, may be zoologic) family could be related to phylogenic proximity. (Some botanists such as Mme M-Th. Cerceau of the National Museum of Natural History in Paris and some immunologists such as Yman[4] have already worked in this field). In such a case, clinicians would be able to use more adequate allergens and improve their results as far as treating hay-fever is concerned.

Summary

The *Gramineae* family is very large and widespread throughout the world. The colonisation of different biotypes has led to an evolution regarding not only morphology, but also biochemistry. For

Table 6 Grasses of the atlantic coast (from Lahondere[6])

Poideae:
Elymus sp.
Ammophila arenaria
Vulpia uniglumis
Puccinella maritima
Bromus rigidus
Koehleria alba
Lagurus ovatus
Arundinoideae:
Pharagmites communis
Arundo donax
Chloridoideae:
Spartina maritima
Spartina towsendi-
Lepturus incurvatus
Cynodon dactylon

This table reflects only the differences between those shores examined and the inner part of the country, mainly during mild winters.

Table 7 Composition of the main allergic extracts distributed in france and used for immunotherapy.

	Blending of three allergenic extracts			
Subfamily	Tribe	"12 grasses" Stallergenes*	"4 grasses" Inst. Pasteur* Production	"Allpyral" Dome*
Pooïdeae	*Poae*	*Dactylis*	*Dactylis*	*Dactylis*
		Festuca	*Lolium*	*Festuca*
		Lolium		*Lolium*
		Poa		
	Avenae	*Arrhenaterum*		*Holcus*
		Avena		
		Anthoxanthum		
		Hoclus		
	Agrostidae			
		Agrostis	*Phleum*	*Phleum*
		Phelum		
	Triticaceae		*Secale*	
	Bromae	*Bromus*		
Chloridoïdeae		*Cynodon*		

*Pharmaceutical companies

Table 8 Comparison of individual sensitivities to the members of different tribes of *Pooideae*, using the prick test on 120 occasions.

	Prick tests on 29 patients challenged with different tribes of *Pooideae*			
	Poae (Dactylis)	*Avenae (Holcus)*	*Agrostidae (Phleum)*	*Triticaceae (Hordeum)*
+++	20	18	23	11
++	6	5	2	10
+	2	2	3	4
0	1	4	1	4

Meaning of the classes:
+++ Strong reaction, oedema, extended flare
++ Reaction with moderate oedema and flare
+ Weak reaction, oedema absent, small flare
0 No reaction

Table 9 Crossed antigenicity of *Pooideae* subfamilies. (According to Yman[4])

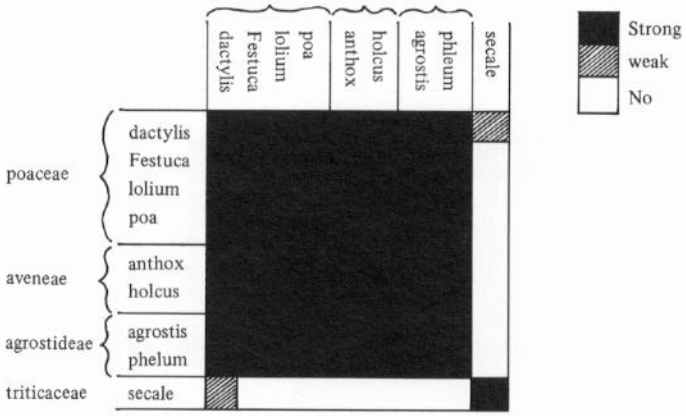
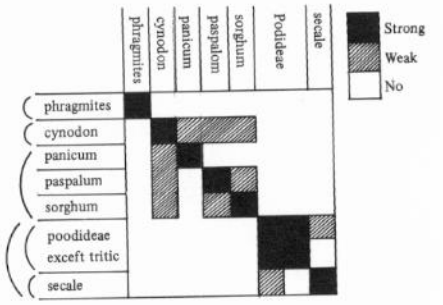


*Table 10** Results of prick-tests in four patients with *Z. Mais* and *Pooideae* extracts

Name	*Poa*	*Holcus*	*Phleum*	*Z. Mais*
Lau.	+	1	+	+++
Gri.		1	++	+++
Gra.	++	1	+	+++
Cou.	+		+	+++
Total	4	3	5	12

*See footnotes to Table 8

Table 11 Crossed antigenicity between subfamilies.



extended areas, the same extracts have been used by allergists to test patients in contact with *Gramineae* of different, and often very distant, biological genera. An alternative could be to select taxons related to the plants found in the patients' environment.

REFERENCES

1. Heywood VH. Flowering plants of the world. Oxford: Oxford Univ Press, 1978.
2. Braun-Blanquet. Pflanzensoziologie. Wien: Springer Verlag, 1951.
3. Bournerias M. Guide des groupements vegetaux de la region parisienne. Paris: Editions Sedes, 1968.
4. Yman L. Relations botaniques et reactions croisees immunologiques dans l'allergie aux pollens. Pharmacia France, not dated.
5. Filou M, Lebas FX, Dib G. Relations tribales entre les graminees. Rev francaise d'allergologie et Immunologie Clinique 1984; 24:100.
6. Lahondere CH. Vegetation des dunes des cotes de Saintonge. Poitiers: Institut Pedagogique National CRDP, Febr 1969.