

EDITORIAL

Pollens and allergic disease: do not overlook your own backyard

Occasionally, clinicians and scientists involved in the field of allergy are alerted to the importance of previously unrecognized or underestimated pollen allergens. Such a situation often arises due to the recent introduction or spread, accidental or otherwise, of a new grass, weed or tree species to a particular environment or locality. For example, the accidental introduction of the South American weed, *Parthenium hysterophorus*, into India along with cereal grains almost three decades ago resulted in the spread of this ragweed related species to most parts of India and the sensitization of a significant proportion of the population [1]. It also may occur due to the failure to recognize (although often anecdotally noted) the importance of long established or indigenous species in provoking allergic disease. In this regard, the allergenicity of pollens from chestnut, *Myrica cerifera* (bayberry), *Parietaria* spp, *P. hysterophorus* and *Mercurialis annua* have recently been highlighted [2–6].

In this issue of *Clinical and Experimental Allergy*, Potter *et al.* draw our attention to the potential importance of the pollen from *Pennisetum clandestinum* (Kikuyu grass) in sensitizing susceptible individuals in South Africa [7]. This grass is one of many indigenous grasses present on this continent and is used for pasture, lawns and playing fields. It belongs to the tribe Paniceae within the Panicoideae sub-family (Fig. 1) and produces small, spheroidal monoporate pollen. The genus contains several species and the most common include *P. clandestinum* and *P. macrum*. Taxonomically, the grass is related to *Cynodon dactylon* (Bermuda grass), another grass commonly found in South Africa [8–10] and, on this basis, it would be anticipated that sera from allergic patients in this environment would react with extracts of both Kikuyu and Bermuda, and also demonstrate extensive crossreactivity [11,12].

Pollen from Kikuyu grass was suspected of being allergenic for some time but, until now, without formal proof [10]. The establishment of a relationship between a particular pollen and allergic disease is governed by the postulates of Thommen [3,13] which enunciate the characteristics necessary to facilitate the development of pollen induced disease. In brief, they indicate that the plant must produce abundant quantities of wind dispersible pollen in the immediate environment of the patient and be shown to contain allergenic material. With regard to Kikuyu grass, the plant was known to be common and, in addition, that the pollen was easily demonstrable in the

atmosphere. That Potter *et al.* have directly demonstrated the allergenicity of Kikuyu pollen using immunoblotting and basophil histamine release techniques suggests that this grass now conforms to all of the postulates.

Despite this, however, the precise clinical significance of this grass is yet to be determined. Given the crossreactivity with other grass pollens, it is sometimes difficult to establish a true incidence of sensitivity but the finding that some of the subjects, previously testing negative to a reagent panel devoid of Kikuyu grass pollen, were positive for this grass adds support to the hypothesis that the pollen is allergenic. However, the degree of sensitization observed with Kikuyu grass pollen (43%) is lower than that seen using either Bermuda (60–80%) or Timothy (92%) [7,9]. As varying techniques have been used to establish allergenicity, further studies (e.g. RAST and skin test) are required to determine the true incidence of Kikuyu grass sensitivity. Interestingly, Timothy grass is absent from the area sampled by Potter *et al.*, yet most grass allergic individuals were sensitive to pollen from this grass, suggesting crossreactivity to some other grass. A similar situation has been reported for Bermuda grass in Denmark [14].

It is clear that a number of horticultural practices influence the incidence of allergy in a particular environment and the data presented by Potter *et al.* indicate that when such practices occur in combination with inherent botanical characteristics, they may also impact on allergic disease. In this regard, they report that male flower production is stimulated by mowing, thus increasing the degree of pollen production. In an urban setting, where the grass is used for lawns and playing fields, this is a frequent occurrence, in marked contrast to the rural setting where mowing is rare. Such practices are likely to increase the atmospheric pollen load in the urban setting and play a significant role in sensitizing susceptible individuals.

Our understanding of the structure of many of the clinically important allergens comprising a variety of grass species has grown significantly in recent years. This has been stimulated by the application of immunochemical, physicochemical and, more recently, molecular cloning techniques to the study of pollen allergens, and the data obtained thus far are summarized in Table 1. It can be seen that the allergens may be divided into a number of groups but the clinically predominant allergens comprise groups I–IV. These data were obtained

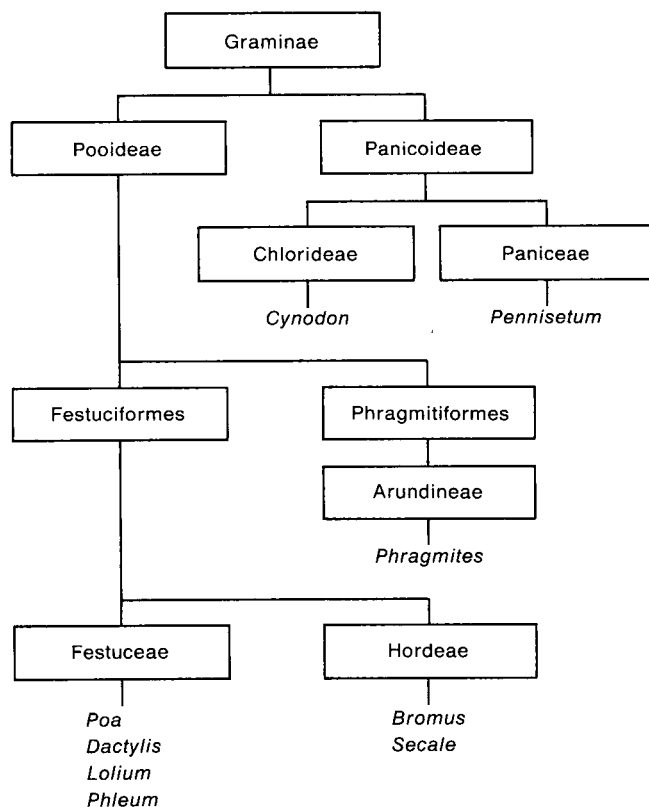


Figure 1. The taxonomical relationship between some allergenically important grass species including Kikuyu grass.

principally using grass pollens comprising the Festuceae tribe such as Rye grass, Timothy grass and Kentucky blue grass (Fig. 1), and they are likely to have direct relevance to grass pollens belonging to other members of this tribe or group, where crossreactivity is high [12]. Although it is reasonable to expect that this scheme will also reflect the allergens (e.g. groups I and X) in pollen from grasses belonging to the sub-family Panicoideae such as Kikuyu, their amino acid sequence homology (and, therefore, immunological crossreactivity) may well be lower. This has clearly been demonstrated with Bermuda grass using specific antisera and inhibition of RAST [15,16].

The limited crossreactivity demonstrated between Bermuda grass pollen and members of the Festuceae tribe has stimulated the study of its allergens, and the data obtained will have a direct bearing on the subsequent investigation of the allergens from Kikuyu grass, given the degree of crossreactivity reported by Potter *et al.* In this regard, several groups have determined the allergenic composition of Bermuda grass pollen using both crossed immunoelectrophoresis and immunoblotting, and all show that the pollen contains a variety of allergens with apparent molecular weights ranging from 14–100 k. Of

these, however, the 32–34 kD allergen was found to be the most important as judged by the frequency of reactivity using sera from diverse ethnic populations including South African, Danish, Australian, American and Chinese [14,17–19].

The Bermuda allergen, originally described by South African workers [19], was recently isolated by Con A lectin affinity chromatography and ion exchange chromatography by Matthiesen and colleagues. They determined the N-terminal sequence of the allergen, designated *Cyn d I* by convention [14], and showed that 12 out of the 27 residues sequenced were identical to those determined for the *Lol p I* allergen from Rye grass. These data clearly establish its relationship to the group I allergens from the Festuceae but the degree of immunological crossreactivity was low. The immunosorbition studies described by Potter *et al.* also indicate that Kikuyu pollen contains an equivalent allergen but, in addition, indicate that it may contain non-crossreacting allergens with apparent molecular weights of 48 and 70 k. It is not known how these relate to previously described allergens (Table 1) but the molecular weight data suggest that they are novel, although similar molecular weight allergens have been demonstrated in Bermuda [17]. Given the relative paucity of data regarding grass pollen allergens from the Panicoideae sub-family, the further characterization of the *Pen c I* allergen and other Kikuyu allergens will be warmly welcomed by those groups involved in allergen characterization.

From a clinical standpoint, the description of a new grass pollen allergen source may be important, although unlikely to influence the conventional pharmacological treatment of seasonal allergic rhinitis and associated conditions. However, it may be of great value with regard to the definition of a pollen sensitivity and subsequent immunotherapy if appropriate, particularly so if the new allergen source is distantly related taxonomically to the pollens comprising the local conventional diagnostic and therapeutic reagents. In such a situation, the degree of crossreactivity exhibited by these reagents may be so low as to be useless in identifying specifically sensitized individuals. In this regard, the data provided by Potter *et al.* will be of particular value to the practice of clinical allergy in South Africa and, further, stimulate the study of other potentially allergenic pollens such as those from other indigenous or introduced grasses such as *Eragrostis curvula* (Boer love grass) and *Setaria* spp (Sticky Bristle grass) belonging to the sub-family Panicoideae, and *Cyperus* spp (Nutgrass) belonging to the sub-family Pooideae [10].

From an academic point of view, the description of a new grass pollen allergen source may also be of great value since its association with clinical disease will be a

Table 1. Physicochemical characteristics of grass pollen allergens

Allergen group	Molecular weight (k)	Number of amino acid residues	pI	Potential glycosylation site(s)	Present in Poideae grasses	Present in Panicoideae grasses	Biological activity/Homology
I	26	240	5.1	Yes	Yes	Yes	Function unknown, allergen located in outer wall and cytoplasm of pollen grains, and around starch granules (amyloplasts)
II	11	97	5.0	No	Yes	?	Function unknown, allergen shows homology with groups I and III grass pollen allergens
III	11	97	8.3	No	Yes	?	Function unknown, allergen shows homology with groups I and II grass pollen allergens
IV	57	?	9	Yes	Yes	?	Function unknown
V(IX)	28-35	283-345	8.8-10.3	No	Yes	?	Function unknown, allergen located within amyloplasts
X	12	?	>9	?	Yes	Yes	Cytochrome c
Profilin	14	?	?	?	Yes	?	Protein involved in actin polymerization (?)

Molecular weights and pI were either calculated using sequence analysis software (Mac Vector; IBI, New Haven, U.S.A.) and data downloaded from the appropriate sequence databanks, or obtained from original references [21-29]. ? indicates data lacking.

sufficient enough imprimatur to encourage a study of the individual allergens *per se*. The data obtained will have relevance to disciplines such as botany, biochemistry and molecular biology. In this regard, very little is known about the biochemical activity of many of the allergens present in pollen despite the availability of complete amino acid sequences. It would be reasonable, however, to conclude that some will be enzymatically active and be involved in a number of biochemical processes necessary for pollen function such as pollen tube growth and pollen-stigma interactions. Interestingly, Knox *et al.* have shown that the group I and V allergens are associated with the abundant starch granules found in pollen and that such respirable granules are released on contact with water [20,21]. Such observations suggest that they may be involved in carbohydrate metabolism and further study of this association, together with the analysis of other grass pollen allergens for enzymatic activity, is warranted.

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