

Grass allergy increases the risk of tree pollen sensitization: A warning to urban planners

Francisco de A. Machado Vieira, MD,^a Ernesto Nascimento Ferreira, MD, and Álvaro A. Cruz, MD^b *Caxias do Sul, Brazil*

Tree pollinosis is an important cause of allergy. Anemophilous tree pollens (blown in the wind) are the major cause of sensitization in predisposed individuals. Entomophilous tree pollens (too heavy to be airborne, carried by insects), are not usually considered a threat to the health. Such trees have been extensively planted along streets and squares.¹

Pollinosis has been reported in subtropical high altitude zones in Brazil.² The predominant allergen in this region is grass pollen. The city of Caxias do Sul (29:10S, 51:10W; 800 m above sea level) has 302,000 inhabitants and belongs to the State of Rio Grande do Sul (Brazil), which borders Argentina and Uruguay. The mean temperature is 16.7°C, with 77% average humidity. The original forest cover of 45% has been replaced by grasses both in the country side, used by cattle farmers, and also in the cities (*Lolium multiflorum*, *Anthoxanthum odoratum*, *Holcus lanatus*, *Bromus inermis*, *Cynodon dactylon*, and *Paspalum notatum*). *Ligustrum japonicum* (lucidum) is a tree with primarily Entomophilous pollen from the Oleaceae family.³ In Caxias it accounts for 68%

of 1680 trees counted in the downtown area. We found that 50.3% of 323 subjects in our clinic who had hay fever and were allergic to grass had a positive skin prick test response to *Ligustrum* pollen. These patients allergic to *Ligustrum* pollen and grass may have symptoms beyond grass pollen season when exposed to *Ligustrum* pollen. Nasal challenge with *Ligustrum* pollen extracts resulted in symptoms of rhinitis in 10 of 10 of these individuals. No association between *Ligustrum* sensitivity and other tree pollen was found when we tested for *Acacia*, *Eucalyptus*, and *Platanus* species.²

A priming effect on the nasal mucosa on repeated antigen exposure was demonstrated by Connell⁴ in 1968 by showing that repeated low-grade exposure of the respiratory mucosa to an allergen lowers the threshold of reactivity. Because *Ligustrum* pollinates in December through January right after the grass season, we thought grass allergy could be predisposing the respiratory mucosa to become sensitized to an uncommon aeroallergen.

To further pursue this possibility, we conducted a cross-sectional study of a sample of the population of Caxias in the downtown area by using skin prick tests to aeroallergens and a standardized questionnaire. A total of 314 individuals (age range, 19 to 67 years; average, 37.8 years) agreed to participate. Our sample is comprised mostly of white European subjects. Allergen prick testing was performed with 11 common aeroallergens: *Dermatophagoides pteronyssinus* (1500 protein nitrogen units [PNU]/mL); *D farinae* (1500 PNU/mL); house dust (5000 PNU/mL); dander of sheep, cat, and dog (5000 PNU/mL); 2 pools of mixed molds (15,000 PNU/mL); and mixed grasses (10,000 PNU/mL) (Merck, Rio de Janeiro, Brazil). The tree pollen allergens were of *Ligus-*

From ^athe Department of Biomedical Sciences, University of Caxias do Sul, School of Medicine, and ^bthe Division of Pulmonary Medicine, Faculdade de Medicina da Universidade Federal da Bahia, and Serviço de Imunologia, Hospital Universitário Prof. Edgar Santos, Brazil.

Supported in part by Universidade de Caxias do Sul.

Reprint requests: Francisco Vieira, MD, Departamento de Ciências Biomédicas, Universidade de Caxias do Sul Rua Francisco Getúlio Vargas, 1130, 95070-560 Caxias do Sul RS, Brazil.

J Allergy Clin Immunol 1998;102:700-1.

Copyright © 1998 by Mosby, Inc.

0091-6749/98 \$5.00 + 0 1/54/92705

trum species (10,000 PNU/mL) and *Platanus acerifolia* (10,000 PNU/mL) (Lester Laboratories, Buenos Aires, Argentina). The diameter of the wheal reaction was measured after 15 minutes by dividing the sum of the 2 largest perpendicular diameters by 2. All subjects were questioned to ensure they had not taken antihistamines. SPSS for Windows (SPSS Inc, Chicago, Ill) was used in performing multiple regression analysis.

Subjects were gardeners, street sweepers, trash collectors, water system workers, and public electricians. Twelve of 314 (3.8%) had symptoms of seasonal rhinitis and asthma, 5.7% had perennial allergic rhinitis, and 1.9% had only asthma. One hundred ten (35%) of the 314 had at least 1 positive skin test response (wheal ≥ 3 mm). Grass test responses were positive in 31 (10%), and *Ligustrum* responses were positive in 15 (5%). Multiple regression analysis involving the variable skin reactivity to *Ligustrum* pollen (dependent) and each of all other allergen reactions shows a multiple correlation coefficient of 0.76 ($F = 0.00001$) for the variable grass, indicating that it accounts for 58% of variations on *Ligustrum* reaction. Such association was not found between *Ligustrum* pollen and any of the other allergens. Only 2 subjects were allergic to *Ligustrum* pollen without being sensitive to grass, whereas 13 of 31 individuals allergic to grass also had a cutaneous reaction to *Ligustrum* pollen. The relative prevalence of *Ligustrum*-positive test responses in grass-sensitive subjects is 59, which indicates that the chance of being allergic to *Ligustrum* is 59 times greater among grass-sensitive persons than in those with negative test responses to grass (Table I).

An association found in a cross-sectional study is no proof of causality. However, the strong correlation between grass and *Ligustrum* reactivity in the absence of association between this pollen and other aeroallergens supports our hypothesis of a predisposing effect of grass season exposure on subsequent *Ligustrum* exposure, resulting in greater sensitization. Nevertheless, it could have another, not exclusive, explanation. There could potentially be a cross-reactivity of IgE against some epi-

TABLE I. Results of skin prick tests to *Ligustrum* antigen according to the results of the grass skin test

	Positive <i>Ligustrum</i> response	Negative <i>Ligustrum</i> response	Total
Positive grass response	13	18	31
Negative grass response	2	281	283
Total	15	299	314

topes of grass and *Ligustrum* pollen. If this is true, it is very likely that the potential for priming and subsequent symptoms provoked by *Ligustrum* tree pollen is even greater. We therefore propose to further analyze whether a predisposing effect of a given pollen season may lead to sensitization to a subsequent different pollen natural exposure. If our findings are confirmed, planning the arborization of any town should take into account the risk of pollinosis in the region, even when using entomophilous pollen trees.

We thank Professor Philip S. Norman and Alkis G. Togias, MD, from Johns Hopkins University, for their wise and kind advice; Professor Ronaldo Wasum (botanist) and Rubens Longhi (agronomist) from the Biological Science Center, University of Caxias do Sul, for their technical support; and Professor Jauner Oliveira from the Statistics and Mathematics Department who performed the statistical analysis of this work.

REFERENCES

1. Villaveces JW. Tree allergy and the street-tree guide. *J Asthma Res* 1973;11:47-56.
2. Vieira FAM, Negreiros EB. Arborização Urbana como Influência na Epidemiologia da Polinose na Cidade de Caxias do Sul, RS, Brasil. *Rev Soc Bras Alerg Imunol* 1989;12:114-9.
3. Lewis WH, Vinay P. North American pollinosis due to insect-pollinated plants. *Ann Allergy* 1979;42:309-18.
4. Connel JT. Quantitative intranasal pollen challenge. II. Effect of daily pollen challenge, environmental pollen exposure, and placebo challenge on the nasal membrane. *J Allergy* 1968;41:123-39.