

Occupational Asthma in Horticulture Caused by *Lathyrus Odoratus*

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INTRODUCTION

Exposure to airborne organic compounds like dusts of plant materials in an indoor working environment may cause asthma.¹⁻⁴ In greenhouse workers with occupational asthma, specific IgE antibodies against various parts of freesia and paprika plants could be demonstrated.⁵ Chrysanthemum, Weeping fig, and Statice are also known to be allergenic in horticulture.⁶⁻⁸

Members of the Leguminosae family have been causatively implicated in occupational asthma, although not in horticulture.⁹⁻¹⁰ We describe a greenhouse worker who developed IgE-mediated allergy to *Lathyrus odoratus* (genus *Viciaeae*, subfamily *Papilionoideae*, family *Leguminosae*). In the Netherlands these cut flowers are cultivated in greenhouses throughout the year and exported worldwide. In the U.S.A., this plant is known also as the perennial pea; the vine can grow 9 feet high and produce a pea-like blossom (Figure 1).

CASE REPORT

A nonsmoking male, 40 years old, had worked since 1982 in greenhouses where *Lathyrus odoratus* is cultivated. He developed perennial rhinoconjunctivitis and intermittent bronchial asthma in 1989. During holidays and weekends his symptoms improved. However, his complaints have been chronic, with frequent exacer-

bations in the evening or at night since 1990. Because of the hot and humid climate in the greenhouses, he could not tolerate a full face mask.

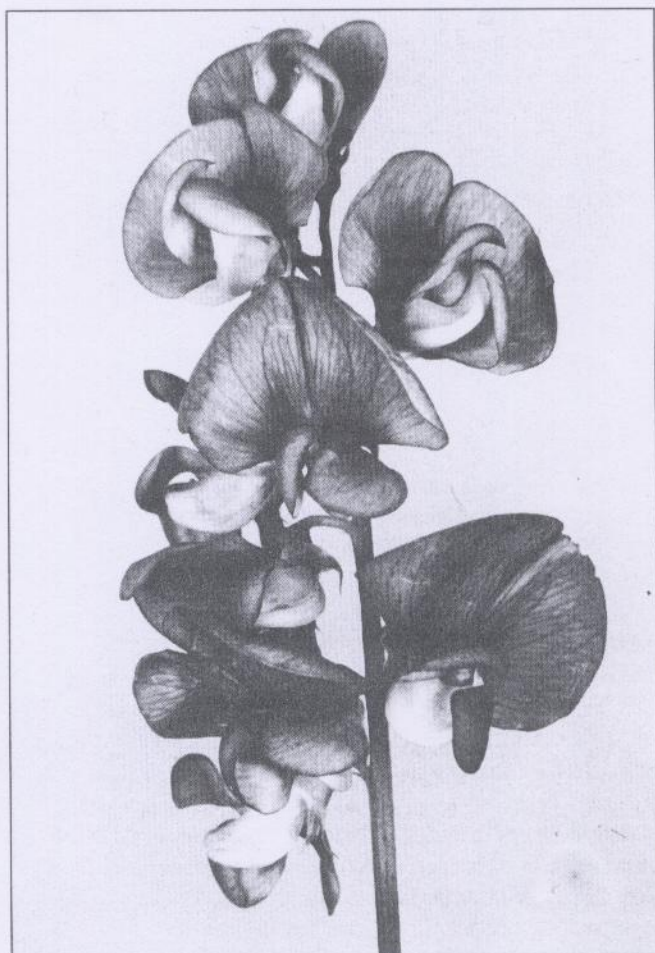


Figure 1. *Lathyrus odoratus*.

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Chest auscultation revealed diffuse expiratory wheezes over both lung fields. Anterior rhinoscopy revealed pale and congestive mucous membranes.

Laboratory studies showed no abnormalities except an elevated eosinophil count in the hemogram. A nasal smear contained more than 15% eosinophils. Chest X-ray was normal. Lung function tests revealed a normal FVC with FEV₁ 82% of predicted baseline value (Tiffeneau index 0.72), with recovery after isoprenaline to 95% of predicted value. Bronchial challenge tests with 0.5 mg/mL histamine chloride showed a 26% fall in FEV₁, and this was reversed by administration of salbutamol.

METHODS

Fresh *Lathyrus odoratus* plants, pollen, and seeds were supplied by the patient from his own greenhouses. Petals, stems, and leaves were cut separately, lyophilized for twenty hours, and ground in a mortar.

For use in skin tests the lyophilized plant parts, seeds, and pollen were extracted in phosphate buffered saline, pH 7.4, 0.03% human serum albumin, 0.5% phenol (Aquagen dilution fluid, ALK Benelux, the Netherlands) for one hour at room temperature. After centrifugation for 10 minutes at 1550 g, the supernatant was passed through a 0.22 µm Millex GS filter (Millipore, the Netherlands). Concentrations expressed as w/v percentage were a 5% petal extract, a 1% pollen extract, a 5% leaf extract, a 2.5% stem extract, and a 10% seed extract, respectively. SPTs with peanut, green pea, and soybean were performed with commercial extracts (ALK Benelux, the Netherlands).

Skin tests were performed and graded as described elsewhere.¹¹ In short, SPTs were performed by application of one drop of undiluted allergenic extract to the skin of the volar side of the forearm. Subsequently the dermis was punctured with a Phazet skin test needle (Pharmacia, Woerden, the Netherlands). SPT results were read after 15 minutes. Cutaneous reactions were compared with reactions to histamine dihydrochloride (base) 10 mg/mL as positive control. Reactions were considered to be positive if the mean wheal diameter was the same or larger than that of the histamine reaction. The mean wheal diameter was calculated by adding the longest diameter to the orthogonal diameter measured at one half of the longest diameter, and dividing by two. Reactions were expressed in mm of mean wheal diameter.

ICTs were performed with 10-fold dilutions of the filtered extracts of *Lathyrus* plant parts in Aquagen dilution fluid. Histamine phosphate (base) 0.01 mg/mL and 0.1 mg/mL were used as positive controls. The combined wheal and erythema ICT reactions were expressed as standardized plus signs according to a grading system of Norman.¹² A concentration inducing a 1+ reaction was regarded as the skin threshold value.

In order to analyze irritative properties of the extracts, all skin tests with *Lathyrus* extracts were done in three

healthy subjects as well. ICTs with common inhalant allergens were performed with commercial extracts (ALK Benelux, the Netherlands).

Total IgE and allergen specific IgE titers against inhalant and food allergens were determined with the CAP system (Kabi Pharmacia, the Netherlands). Specific IgE against *Lathyrus* pollen was determined by RAST. Per RAST, proteins extracted from 0.5 mg *Lathyrus* pollen were covalently coupled to 2 mg agarose beads.

For use in the histamine release test, 20 mg *Lathyrus* pollen were extracted. After centrifugation, the supernatant was used in the release experiments. Histamine in samples was determined by an automated fluorometric method.¹³ In some experiments the washed leucocytes were incubated in buffer that contained 44% deuterium oxide (Merck, Darmstadt, Germany) to potentiate the histamine release reaction.

Serial PEFR measurements were obtained by the patient himself using a Wright mini peak flow meter. The only medication consisted of salbutamol inhalation aerosol (100 µg per dose) when necessary.

RESULTS

SPT results are shown in Table I. All undiluted *Lathyrus* extracts gave positive wheal and flare reactions, as did the commercial extracts of related members of the Leguminosae family. In three control subjects these tests were negative. ICTs with diluted extracts of *Lathyrus* plant parts, pollen especially, were positive in concentrations that elicited no reactions in healthy controls. In addition, the patient showed a positive ICT to house-dust mite extract (Table II).

In all skin tests, the control solution (Aquagen dilution fluid) elicited no reactions. Skin reactions to histamine phosphate (0.01 and 0.1 mg/mL respectively) were posi-

TABLE I
Results of Skin Prick Tests in a Patient with Allergy to *Lathyrus Odoratus*

	Patient	Control	Control	Control
Histamine				
10 mg/mL	6	6	7	5
Negative control	—	—	—	—
<i>Lathyrus</i> petal	7	—	—	—
<i>Lathyrus</i> pollen	9	—	—	—
<i>Lathyrus</i> leaf	7	—	—	—
<i>Lathyrus</i> seed	6	—	—	—
<i>Lathyrus</i> stem	6	—	—	—
Green pea	6	—	—	—
Peanut	7	—	—	—
Soybean	6	—	—	—

Mean wheal reactions are graded in millimeters; — = no reaction.

TABLE II

Results of Intracutaneous Skin Tests in a Patient with Allergy to *Lathyrus Odoratus*. Tests were performed with 10-fold Dilutions of the Original Plant Part Extracts.

		10^{-8}	10^{-7}	10^{-6}	10^{-5}	10^{-4}
Histamine 0.1 mg/mL	3+					
Histamine 0.01 mg/mL	2+					
Negative control	—					
Lathyrus petal 5%		—	—	—	1+	2+
Lathyrus pollen 1%		—	1+	2+	3+	nt
Lathyrus leaf 5%		—	—	—	1+	2+
Lathyrus seed 10%		—	—	—	1+	2+
Lathyrus stem 2.5%		—	—	—	1+	2+
HDM 30 BU/mL	3+					
HDM 3 BU/mL	2+					
HDM 0.3 BU/mL	1+					

Results are expressed as standardized + signs; — = no reaction; nt = not tested; BU/mL = biological units per mL; HDM = house-dust mite (*D. pteronysinus*).

tive. Figure 2 shows the IgE binding to Lathyrus pollen-Sepharose after incubation of serum from the patient and five control sera with increasing amounts of Lathyrus pollen-Sepharose.

Specific IgE against Lathyrus odoratus pollen was detected in the serum of this patient by RAST. Specific IgE against house dust mite, green pea, peanut, and soybean could be detected as well (Table III).

At first, standard histamine release experiments without D_2O were done. Because of low range release signals, in a second experiment the reactions were intensified with deuterium oxide. Figure 3 shows that components from Lathyrus odoratus pollen were able to release histamine from washed leukocytes.

In Figure 4, the results of PEFR monitoring are shown. Mean PEFR values during workdays in the greenhouse were reduced more than 20 per cent compared with days without exposure. Increased bronchial hyperreactivity was demonstrated during the first investigation period at work (PD_{20} : 0.5 mg/mL after histamine challenge). After a 10-day period at home, this threshold value had risen to 4 mg/mL histamine, causing a 22 per cent reduction in FEV_1 .

DISCUSSION

Lathyrus plants may cause allergic or toxic reactions. Lathyrism is a form of toxic motoneuron disease induced by a prolonged dietary intake of Lathyrus sativus seed (chickling pea). The toxic mechanism is related to a neuroexcitatory amino acid found in the seed. Lathyrus sativus is used for feeding animals, but in parts of Asia and Africa, especially in times of famine, it is also used for human consumption. The signs and symptoms are

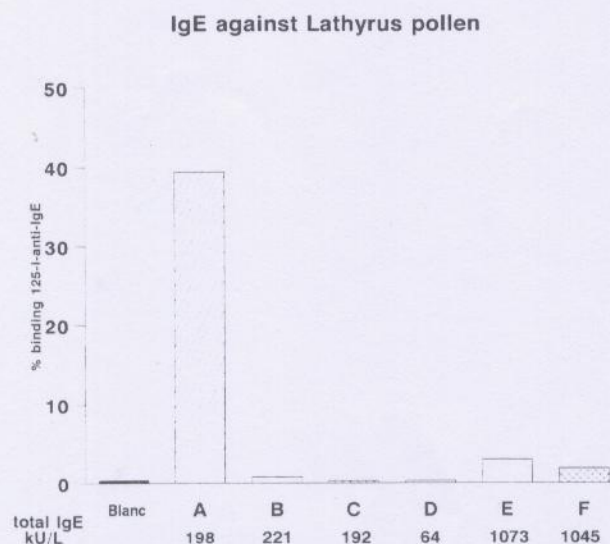


Figure 2. Measurement of specific IgE against Lathyrus pollen in serum of patient A and five control sera (B-F) with different total IgE levels. Blank = no serum added.

TABLE III

CAP/RAST Results of a Patient with Allergy to *Lathyrus Odoratus*. Results are Expressed as CAP Titers (kU_a/L) and CAP Classes (Pharmacia, Woerden, the Netherlands).

	Concentration Ratio (kU_a/L)	CAP Class
House dust mite	12.5	3
Peanut	2.82	2
Green pea	0.710	2
Soybean	1.07	2
Lathyrus odoratus pollen	25.7	4

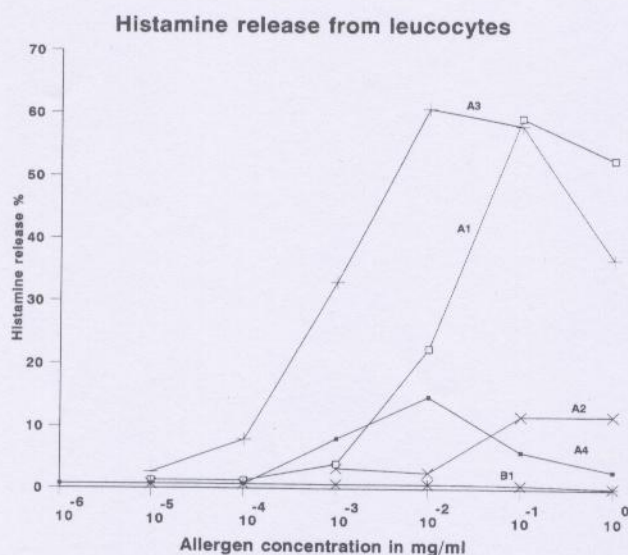


Figure 3. Histamine release of leucocytes from a patient allergic to *Lathyrus* pollen and a negative control B1. A1 and A2 *Lathyrus* pollen with and without deuteriumoxide. A3 and A4 positive control *Dermatophagoides pteronyssinus* with and without deuterium oxide.

consistent with increased central nervous system excitation and include a spastic paraparesis, muscle cramps, and tremor mainly of the lower limbs, frequency and urgency of micturition, abdominal cramps, and diarrhea.^{14,15} Valdivieso et al. described a child with asthma caused by IgE mediated allergy to *Lathyrus sativus* flour.¹⁶

Lathyrus odoratus is not suitable for human consumption in contrast to the taxonomically related green pea, peanut, and soybean. However, the latter three allergens could be consumed by our patient without causing adverse food reactions despite the presence of specific IgE. This occurrence of sensitization to related edible legumes might be based on cross reactivity without overt allergic disease.¹⁷

From the beginning, the clinical history and the relatively high numbers of eosinophils in blood and nasal smear of this patient suggested that antigens from the working environment could be elicitors of hypersensitivity reactions. The presence of an IgE mediated allergic mechanism could be based on positive immediate skin reactions with *Lathyrus odoratus* plant parts, demonstration of specific IgE antibodies to *Lathyrus odoratus* pollen by means of RAST, and positive histamine release tests with washed leucocytes.

Specific bronchial challenge tests are considered the gold standard to confirm the diagnosis of work-related asthma.¹⁸ However, our patient did not give informed consent to participate in such a procedure after explanation of the possible risks and because of the necessity of hospital admission.

Supportive evidence of a cause and effect relationship between specific IgE antibodies against *Lathyrus* plant

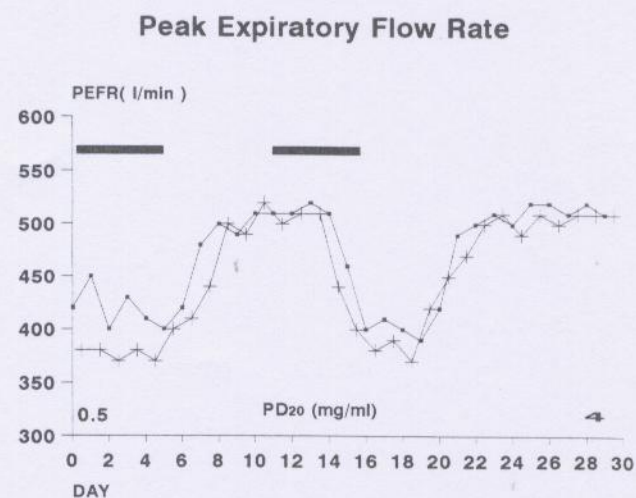


Figure 4. Pattern of PEFR in a patient with occupational asthma to *Lathyrus odoratus*. Periods at work are indicated by the thick line. PEFR values include some results taken after bronchodilator. PD₂₀ provocative dose of histamine chloride producing a more than 20% fall in FEV₁.

parts and this patient's airway response at work was obtained by means of serial PEFR monitoring and measurement of bronchial hyperreactivity to histamine during and without workplace exposure.¹⁹⁻²⁴

Although we are aware of the pitfalls that may occur in PEFR monitoring and interpretation, we concluded that *Lathyrus odoratus* plant parts were the cause of occupational asthma in this patient.

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