

Occupational allergy caused by spathe flower (*Spathiphyllum wallisii*)

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Occupational allergy caused by plants is seldom reported although it is probably relatively common. We report on a 22-year-old male atopic caretaker of plants who developed IgE-mediated allergic rhinitis, laryngitis, pharyngitis, and contact and generalized urticaria caused by exposure to spathe flower (*Spathiphyllum wallisii*) while he was working for a firm that supplied plants to offices. He also had an asthmatic attack at work, but in bronchial provocation tests conducted 8 months after he had stopped doing the work in question, he developed rhinoconjunctivitis, pharyngitis, and laryngitis, but exhibited neither bronchial reaction nor fall in PEF values. Prick tests with spathe flower gave 3+ reactions for exudates from the flower, pollen, stem, and leaves. He also had several positive reactions to fruits, vegetables, and spices, but not to natural rubber latex. The radioallergosorbent test with spathe flower was positive (3.4 PRU/ml, close to class 3). In protein staining with SDS–PAGE, one heavy band was detected at about 14 kDa, and other faint bands were visible on both sides. Six faint bands were detected at the mol. mass range of 30–67 kDa. In IgE immunoblotting, one heavy band was detected at about 14 kDa. The patient became symptomless after he had ceased working with plants.

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Occupational allergy caused by plants is seldom reported although it probably is relatively common (23). Florists, gardeners, and floriculturists have developed occupational respiratory allergy to baby's breath (*Gypsophila paniculata*) (27, 29), weeping fig (3), dried flowers of *Limonium tataricum* (24), sunflower (4), and mimosa (*Acacia floribunda*) (2). Here we report on a caretaker of plants who developed IgE-mediated allergic rhinitis, laryngitis, pharyngitis, contact urticaria, and generalized urticaria caused by spathe flower (*Spathiphyllum wallisii*).

Case report, methods, and results

A 22-year-old atopic man had been working for a firm that hires out plants. The firm both hired out the plants, and was responsible for taking care of the plants, including cleaning and watering them in customers' offices. The patient had had atopic dermatitis since childhood. On the job, he first had mild, work-related respiratory symptoms, but within 10 months he developed an asthmatic reaction, as well as severe swelling of the eyes and urticarial lesions in the arm flexures. At this time, he was exposed to *S. wallisii* (Fig. 1) and *Dracaena fragrans*. About 90% of the patient's work involved tending spathe

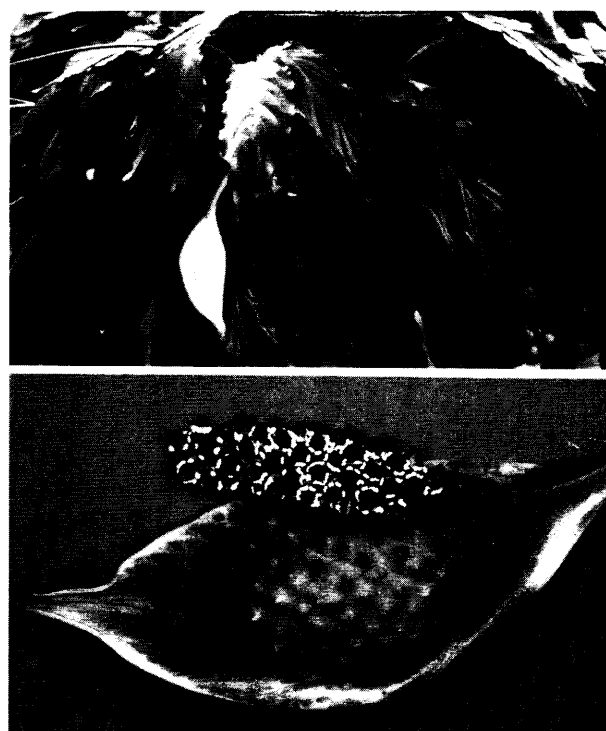


Fig. 1. Spathe flower (*Spathiphyllum wallisii*) (top) with high amounts of pollen (bottom). Patient had positive prick test reactions to pollen, stem, and leaves of spathe flower.

flower, weeping fig, dracaena, sentry palm (*Howea belmoreana*), and *Aglaonema commutatum*, but he was also exposed to other plants, such as ferns (Filicinae), other figs, and elk-clover (*Aralia californica*), at work. The patient had been an occasional smoker, but not for the last 8 months. Prick tests and the radioallergosorbent test (RAST) were done 1 month after the respiratory incident. The bronchial provocation tests were done 7–8 months after the incident, and prick tests with spathe flower were repeated at that time. After the incident, the patient had stopped working for the firm in question. He remained hyperreactive for 2 months, but has been symptomless since then.

Skin tests

Prick testing was done as described previously (12). The results were compared with those for histamine, 10 mg/ml, as follows: 4+, wheal size twice that of histamine; 3+, wheal size that of histamine; 2+, wheal size half that of histamine; 1+, wheal size less than half that of histamine; –, no wheal. In the series of 20 common inhalation allergens (Allergologisk Laboratorium A/S, ALK, Horsholm, Denmark), 3+ reactions were obtained with several Finnish grasses and mugwort, while birch gave a 2+ reaction. In a series of tests with vegetables, fruits, and nuts, histamine size or larger reactions were obtained as follows: potato, celery, banana, and hazelnut, 4+; carrot, rutabaga, parsnip, onion, tomato, and sweet pepper, 3+. Apple and parsley gave a 2+ reaction, whereas kiwi and pea were negative. Spices gave the following results: white pepper 3+, curry 3+, and soybean 2+; cardamom and allspice were negative.

Prick testing with spathe flower was done as follows. A piece of leaf, stem, or flower of *S. wallisii* was slightly crushed and broken with a knife, and the broken piece of the plant was then put on the skin in a drop of water. Pricking was then done through the leaf, stem, or flower. Pollen was tested as is in a drop of water. The prick test substances were prepared and used the same day that the prick testing was done. Prick testing with the other flowers from the patient's workplace was done in the same way.

Prick testing with spathe flower was done twice, giving 3+ reactions on both occasions, i.e., larger wheals than histamine (wheal diameter 6 mm) for exudates from the flower, pollen, and stem (8 mm plus pseudopodia), respectively, and leaves (6 mm plus pseudopodia). The leaf of *D. fragrans* induced a very small wheal, while the stem induced a clearly positive prick test reaction (3+). Natural rubber latex, weeping fig, and *A. commutatum* were negative. Twenty (10 atopic and 10 nonatopic) control

persons had negative prick test reactions with spathe flower (stem and leaf), and 10 with *D. fragrans* (stem and leaf).

Patch testing was done by the Finn chamber method on the upper back, as described previously, with 48 h occlusion (6). Epicutaneous tests with the European standard series (patch test substances from Chemotechnique Diagnostics AB, Malmö, Sweden, and Epikon, Helsinki, Finland), 29 plant extracts (see Reference 14), 16 plant allergens (14), and four plants brought in by the patient, namely, spathe flower, dracaena, weeping fig, and *A. commutatum*, were negative except that thimerosal provoked a 2+ allergic reaction.

In vitro immunoassays

One leaf of spathe flower was cut into pieces and extracted overnight in a ratio of 1 g/5 ml potassium phosphate buffer, 0.1 mol/l, pH 7.4. The total protein concentration, as measured by the Bradford (Bio-Rad Laboratories, Richmond, CA, USA) method with bovine immunoglobulin as the standard, was 3 mg/ml. Similarly, extracts from dracaena, tuft root, anthurium, ivy arum, and monstera were prepared (Table 1). Extracts were used as source material for RAST disks; spathe flower and dracaena were also used in immunoblotting studies.

RAST disks were prepared as described by Ceska & Lundkvist (5) and Yman et al. (30), 100 µl of the various extracts being coupled per disk. Phadebas RAST reagents (Pharmacia Diagnostics AB) were used for the quantification of specific IgE. Values higher than 0.35 kU/l were considered to be positive.

For immunoblotting, reduced sample proteins (200 µg in 150 µl of sample buffer) and mol. wt. markers (Electrophoresis Low Molecular Weight Calibration Kit, Pharmacia-LKB Biotechnology, Uppsala, Sweden) were separated by SDS-PAGE in a 15% gel with a 4% stacking gel, according to Laemmli (16), and transferred to Immobilon-P sheet (Millipore 0.45 m, Millipore Co, Bedford, MA, USA) for protein staining with Coomassie brilliant blue and to nitrocellulose sheet (Bio-Rad 0.22 µm) in

Table 1. Patient RAST to six plants

Plant	Latin name (genus or species)	Family	RAST kU/l
Spathe flower	<i>Spathiphyllum wallisii</i>	Araceae	3.4
Dracaena	<i>Dracaena</i>	Agavaceae	0.6
Tuft root (syn. dumb cane)	<i>Dieffenbachia seguine</i>	Araceae	0.5
Anthurium	<i>Anthurium</i>	Araceae	<0.35
Ivy arum	<i>Epipremnum aureum</i> , (syn. <i>Scindapsus aureus</i>)	Araceae	<0.35
Monstera	<i>Monstera deliciosa</i>	Araceae	<0.35

Novablot apparatus (Pharmacia), according to Towbin et al. (28). The IgE antibodies bound from the serum (diluted 1:2) to allergens on the nitrocellulose were detected with radiolabeled anti-IgE (Pharmacia), as described previously (21).

Sera from five atopic patients and one nonatopic patient were used as controls, in both immunoblotting tests and RAST.

The results of the RAST determination are presented in Table 1. The patient's serum showed distinct RAST positivity for spathe flower (3.4 PRU/ml, class almost 3) and lower values for dracaena, 0.6 PRU/ml (class 1), and tuft root, 0.5 PRU/ml (class 1). Anthurium, ivy arum, and monstera were negative. Control sera remained negative in every RAST.

The patient's RAST (Pharmacia) yielded negative results for dog epithelium, *Dermatophagoides pteronyssinus*, and group RAST for animal epithelia and molds, but group RAST for house dust was positive (1.3 PRU/ml; class 2).

In protein staining with SDS-PAGE, one heavy band was detected at about 14 kDa, and other faint bands on both sides. In addition, six faint bands were detected in the range of 30–67 kDa. In IgE immunoblotting, one heavy band of about 14 kDa was detected for spathe flower (Fig. 2). No other bands were visible. No bands were detected with dracaena as the sample (results not shown). No bands were shown with the control sera.

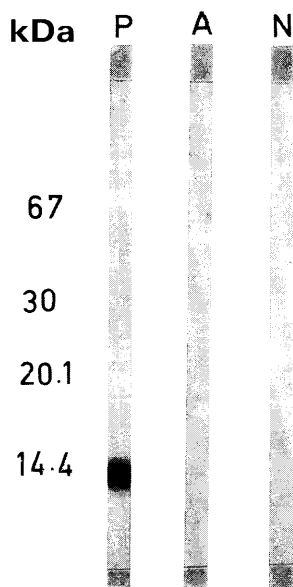


Fig. 2. Immunoblot analysis of the binding of IgE antibodies from the patient's serum (P), from atopic control serum (A) and from nonatopic control serum (N) to extract of spathe flower. Molecular weight markers (kDa) on the left.

Bronchial provocation tests

Bronchial provocation tests were done 8 months after the respiratory distress reaction at work by the method of Pepys & Hutchcroft (22). Cutting of lettuce leaf was used as placebo; it caused no fall in the PEF values and no other respiratory or skin symptoms. Cutting of spathe flower in the provocation chamber induced conjunctivitis, pharyngitis (for criteria, see Reference 13), and laryngitis: these were considered to be allergic reactions. Rhinomanometry revealed a 59% increase in resistance, a finding which supports the diagnosis of allergic rhinitis. An itching, eczematous reaction in accordance with contact urticaria was seen on the upper lids. There was no bronchial reaction or fall in PEF values.

Other tests

The blood test results were unremarkable, the serum total IgE being 82 kU/l. The PEF values were stable, about 530 l/min. There was slight obstruction in the pulmonary values: FVC 6.37 l/114%; FEV₁ 4.81 l/100%; FEV% 75/86%; PEF 8.19 l/s/74%. No significant change was obtained with a bronchodilating drug. Histamine challenge was done 8 months after the respiratory distress incident, and was negative.

The patient's diagnoses were occupational allergic rhinoconjunctivitis, pharyngitis, and laryngitis, and occupational allergic contact urticaria. The patient had to resign from his job and is being retrained for a new job.

Discussion

The patient had had exceptionally strong occupational exposure in washing, cleaning, and trimming the plants, i.e., direct contact with the plants. The allergic reaction included respiratory symptoms and skin symptoms, but no asthmatic symptoms developed when he was exposed to spathe flower in a chamber. When the provocation test was done, the patient had not had any exposure to the plant for 8 months; it is thus possible that the amount of specific IgE antibodies against spathe flower had decreased, resulting in the negative provocation result, even though he had had an asthmatic reaction at work, and was thereafter hyperreactive for 2 months.

Thirty-six species of *Spathiphyllum* are known to occur on the Philippine Islands and in Central and tropical South America (18). *Spathiphyllum* belongs to the Araceae family. Araceae species may contain glycosides; alkaloids; crystals of calcium oxalate, which is intensely irritating to the skin (7, 18); and proteolytic enzymes (7). Prick tests among controls did not provoke a reaction, and patch tests with parts of the plants caused no irritation, indicating

that the parts of the plant we used for skin testing were not irritants. Furthermore, it was shown that our patient had developed specific IgE antibodies.

We are not aware of previous reports of respiratory allergy caused by spathe flower. Contact dermatitis has been reported to be due to some species of the Araceae family, i.e., irritant contact dermatitis caused by *Dieffenbachia* (10), and allergic contact dermatitis caused by *Philodendron* (15) and *Scindapsus* (19). Alkyl resorcinols may be the substances inducing the delayed type IV allergy caused by *Philodendron* (25, 26). *Philodendron* species may be toxic, and one infant death caused by them has even been reported (17).

In accordance with his atopic background, the patient showed allergic prick test reactions to many allergens. However, the reaction to spathe flower was specific, and 10 atopic control persons had no reaction to spathe flower. *In vitro* tests also indicated that specific sensitization had taken place. The results of RAST and IgE immunoblotting were distinctly positive for spathe flower in our patient's serum. RAST was only slightly positive for dracaena and tuft root, and negative for other species of the Araceae family (Table 1).

The patient had a positive prick test reaction to both spathe flower and dracaena. These belong to different families, but cross-reactions may still occur; for example, banana and natural rubber latex cross-react (20). The patient may also have become concomitantly sensitized to both plants, to which he had been occupationally exposed. Interestingly, he did not show positive prick test reactions and RAST for other species of the Araceae family. Provocation tests with dracaena were not done because the patient was already diagnosed as having one occupational respiratory disease.

In IgE immunoblotting, one heavy band was detected at about 14 kDa. An IgE-binding protein of 14 kDa has been identified as profilin in several plant species (trees, grasses, weeds) and is believed to be a plant panallergen (8). In addition, 14–15-kDa allergens have been found in several vegetables and also in natural rubber latex (1, 11), but "similar" mol. mass does not prove that the allergens are identical.

In conclusion, the patient had developed specific IgE immunoglobulins through either skin or respiratory contact with spathe flower. In further exposure, the patient probably developed both direct respiratory symptoms from respiratory exposure to the allergen, and contact urticaria/dermatitis symptoms (9) from skin contact with the plant allergens. Respiratory exposure probably also provoked generalized urticaria symptoms.

References

1. ALENUS H, MÄKINEN-KILJUNEN S, TURJANMAA K, PALOSUO T, REUNALA T. Characterization of latex antigens and allergens in surgical gloves and natural rubber by immunoelectrophoretic methods. *J Allergy Clin Immunol* 1992; 90: 230–5.
2. ARIANO R, PANZANI RC, AMEDEO J. Pollen allergy to mimosa (*Acacia floribunda*) in a Mediterranean area: an occupational disease. *Ann Allergy* 1991; 65: 253–6.
3. AXELSSON IGK, JOHANSSON SGO, ZETTERSTRÖM O. Occupational allergy to weeping fig in plant keepers. *Allergy* 1987; 42: 161–7.
4. BOSQUET J, DHIVERT H, CLAUZEL AM, HEWITT B, MICHEL FB. Occupational allergy to sunflower pollen. *J Allergy Clin Immunol* 1985; 75: 70–4.
5. CESKA M, LUNDKVIST U. A new and simple radioimmunoassay method for the determination of IgE. *Immunochemistry* 1972; 9: 1021–30.
6. ESTLANDER T. Occupational skin disease in Finland. Observations made during 1974–1988 at the Institute of Occupational Health, Helsinki. *Acta Derm Venereol (Stockh)* 1990; Suppl. 155: 1–85.
7. HAUSEN BM. Allergiepflanzen – Pflanzallergenen. Handbuch und Atlas der allergie-induzierenden Wild- und Kulturpflanzen. Kontaktallergene. Landsberg: Ecomed, 1988.
8. HIRSCHWEHR R, VALENTA R, EBNER C, et al. Identification of common allergenic structures of hazel pollen and hazelnuts: a possible explanation for sensitivity to hazelnuts in patients allergic to tree pollen. *J Allergy Clin Immunol* 1992; 90: 927–36.
9. HJORTH N, ROED-PETERSEN J. Occupational protein contact dermatitis in food handlers. *Contact Dermatitis* 1976; 2: 28–42.
10. VON IPPEN H, WERETA-KUBEK M, ROSE U. Haut- und Schleimhautreaktionen durch Zimmerpflanzen der Gattung *Dieffenbachia*. *Dermatosen* 1986; 34: 93–101.
11. JORDAN-WAGNER DL, WHISMAN BA, GOETZ DW. Cross-allergenicity among celery, cucumber, carrot, and watermelon. *Ann Allergy* 1993; 71: 70–9.
12. KANERVA L, ESTLANDER T, JOLANKI R. Skin testing for immediate hypersensitivity in occupational allergology. In: MENNÉ T, MAIBACH HI, eds. *Exogenous dermatoses; environmental dermatitis*. Boca Raton, FL: CRC Press, Inc, 1991: 103–26.
13. KANERVA L, ESTLANDER T, JOLANKI R, PEKKARINEN E. Occupational pharyngitis with allergic patch test reactions from acrylics. *Allergy* 1992; 47: 571–3.
14. KANERVA L, ESTLANDER T, TARVAINEN K, JOLANKI R. Active sensitization caused by elecampane (*Inula helenium*). *Am J Contact Dermatitis* 1994; 5: 30–3.
15. KNIGHT TE. *Philodendron* induced dermatitis. Report of cases and review of the literature. *Cutis* 1991; 48: 375–8.
16. LAEMMLI UK. Cleavage of structural proteins during the assembly of the head of bacteriophage T4. *Nature* 1970; 227: 680–5.
17. MCINTIRE MS, GUEST JR, PORTERFIELD JF. *Philodendron* – an infant death. *J Clin Toxicol* 1990; 28: 177–83.
18. MITCHELL J, ROOK A. Botanical dermatology. Plants and plant products injurious to the skin. Vancouver: Greengrass, 1979.
19. MOBACKEN H. Allergic plant dermatitis from *Scindapsus aureus*. *Contact Dermatitis* 1975; 1: 60–1.
20. M'RAIHI L, CHARPIN D, PONS A, BONGRAND P, VERVLOET D. Cross-reactivity between latex and banana. *J Allergy Clin Immunol* 1991; 87: 129–30.
21. MÄKINEN-KILJUNEN S, TURJANMAA K, PALOSUO T, REUNALA T. Characterization of latex antigens and allergens in surgical gloves and natural rubber by immunoelectro-

- phoretic methods. *J Allergy Clin Immunol* 1992; 90: 230–5.
22. PEPYS J, HUTCHCROFT BJ. Bronchial provocation tests in etiologic diagnosis and analysis of asthma. *Am Rev Respir Dis* 1975; 112: 829–59.
23. PIIRILÄ P, KESKINEN H, LEINO T, TUPASELA O, TUPPURAINEN M. Occupational asthma caused by decorative flowers: review and case reports. *Int Arch Occup Environ Health* 1994; 66: 131–6.
24. QUIRCE S, GARCÍA-FIGUEROA B, OLAGUÍBEL JM, MUÑOZ MD, TABAR AI. Occupational asthma and contact urticaria from dried flowers of *Limonium tataricum*. *Allergy* 1993; 48: 285–90.
25. REFFSTRUP T, BOLL RM. Allergenic 5-alkylresorcinols and 5-alkenylresorcinols from *Philodendron* spp. *Phytochem Oxford* 1985; 24: 2563–6.
26. REFFSTRUP T, HAMMERSHOY O, BOLL RM, SCHMIDT H. *Philodendron scandens* Koch et Sello subsp. *oxycardium* (Schott) Bunting, a new source of allergenic alkyl resorcinols. *Acta Chem Scand* 1982; B36: 291–4.
27. SCHROECKENSTEIN DC, MEIER-DAVIS S, YUNGINGER JW, BUSH RK. Allergens involved in occupational asthma caused by baby's breath (*Gypsophila paniculata*). *J Allergy Clin Immunol* 1990; 86: 189–93.
28. TOWBIN HT, STAHELIN T, GORDON J. Electrophoretic transfer of proteins from polyacrylamide gels to nitrocellulose sheets: procedure and some applications. *Proc Natl Acad Sci U S A* 1979; 76: 4350–4.
29. TWIGGS JT, YUNGINGER JW, AGARWAL MK, REED CE. Occupational asthma in a florist caused by the dried plant baby's breath. *J Allergy Clin Immunol* 1982; 69: 474–7.
30. YMAN L, PONTERIUS G, BRANDT R. RAST-based allergen assay methods. *Dev Biol Stand* 1975; 29: 151–65.