

are least likely to cross-react with PPD are non-azo dyes, which cannot be broken down by the skin azo-reductase enzymes to yield PPD.²

LLAPTRs to PPD and DY3 have been described.^{3,4} However, there are no reported cases of LLAPTRs to DO3 and DR1. Skin persistence of the allergen and/or defective downregulation of the cell-mediated immune response have been hypothesized as possible causes for LLAPTRs.

In a study on dose-time relationship for elicitation reaction to PPD in sensitized subjects, White et al demonstrated that, over the time period tested, the allergenic component of PPD accumulates in the skin.⁵ This was corroborated in the same study by skin-binding data showing persistence of radiolabeled PPD following repeated application on rat skin.

The LLAPTR-inducing azo dyes in our case may be degraded to PPD in the skin by the azo-reductase enzymes.² Consequently, the skin persistence of PPD could hypothetically have contributed to the occurrence of the LLAPTRs, both to PPD and to the azo dyes showing PPD as their metabolic derivative.

According to Bygum and Andersen, LLAPTRs seem to be more frequent in patients with multiple strong positive reactions.¹ In contrast, in our experience—referring to just one case—LLAPTRs involve multiple reactions, all being initially weak positive. Similar to what was observed for LLAPTRs to PPD, the eruption following the application of the hair dye also presented a long-term evolution, despite corticosteroid treatment.

AUTHOR CONTRIBUTIONS

Giuseppe Mancuso: Conceptualization; data curation; formal analysis; writing-original draft; writing-review and editing.

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Occupational allergic contact dermatitis and contact urticaria caused by indoor plants in plant keepers

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Indoor green walls have gained popularity, and professional care of office and other indoor plants has become more common. Plant keepers involved in indoor plant care may be at risk of delayed and

immediate allergy to the plants they handle. We describe seven plant keepers diagnosed with occupational skin disease caused by allergy to indoor plants (Table 1).

TABLE 1 Patient characteristics and results of clinical examinations

Pt. no/age (years)	1/42	2/27	3/28	4/49	5/27	6/30	7/54
Year of study	2020	2019	2019	2019	2019	2018	2010
Occupation and time in 5 y as plant keeper including care of indoor green walls	5 y as plant keeper including care of indoor green walls	Horticulturist, 9 mo as plant keeper in care of indoor green walls	Gardener, 2 y in care of indoor green walls	9 y as plant keeper/ care of office plants and indoor green walls	3.5 y as plant keeper/ gardener in a green decor company, also indoor green walls	11 y as indoor plant keeper (no indoor green walls)	7 y as plant keeper in care of indoor plants (no indoor green walls)
Symptoms associated with plant care work	CU and rhinitis	Eczema on arms and back of hands	Eczema on forearms and upper arms, rhinitis, conjunctivitis	CU and rhinitis	CU and rhinitis	CU and rhinitis	CU and rhinitis
Positive patch test results	NT	<i>P. scandens</i> ^a as is (moistened with eth) + +, "as is" (moistened with aqua) +, UE (eth) + +	<i>P. scandens</i> ^a "Brasil" ^{ab} "as is" (moistened with aqua) +, "as is" (moistened with eth) ? +, UE (eth) +; <i>P. scandens</i> "as is" (moistened with aqua) +, "as is" (moistened with eth) ? +, UE (eth) +, UE (acet) ? +	None	NT	NT	NT
Positive skin prick test results to indoor plants handled at work (size of the wheal)	<i>Ficus benjamina</i> leaf 5 mm ps; <i>Ficus binnendijkii</i> / <i>alii</i> (narrow leaf fig) leaf 8 mm ps	None	None	<i>Spathiphyllum</i> (spathe flower) flower 5 mm, stem 3 mm, leaf 3 mm; <i>Ficus benjamina</i> leaf 5 mm; <i>Davallia</i> (fern) leaf 3 mm	<i>Ficus benjamina</i> leaf 9 mm ps; <i>Spathiphyllum</i> leaf 6 mm ps, pollen/ flower 6 mm ps	<i>Ficus benjamina</i> leaf 8 mm; <i>Spathiphyllum</i> leaf 5 mm, pollen/ flower 10 mm; <i>Yucca</i> leaf 5 mm; <i>Euphorbia</i> stem 4 mm	<i>Ficus benjamina</i> leaf 5 mm; <i>Spathiphyllum</i> leaf 5 mm; <i>Yucca</i> leaf 4 mm
Size of the histamine wheal in skin prick test	6 mm	5 mm	5 mm	5 mm	5 mm	6 mm	6 mm
Open skin application test results ^b	<i>Ficus binnendijkii</i> / <i>alii</i> leaf +; <i>Ficus benjamina</i> leaf +	NT	NT	<i>Spathiphyllum</i> flower +, stem +	Negative with <i>Ficus benjamina</i> and <i>Spathiphyllum</i> leaves	<i>Spathiphyllum</i> flower ++; Negative with <i>Ficus benjamina</i> leaf and sap	<i>Ficus benjamina</i> leaf +; <i>Yucca</i> leaf +
Positive serum specific IgE measurements	<i>Ficus benjamina</i> 10 IU/L	NT	None	NT	NT	<i>Ficus benjamina</i> 3.3 IU/L	<i>Ficus benjamina</i> 2.46 IU/L
Occupational skin diagnoses related to allergy to plants at work	Allergic CU caused by <i>Ficus benjamina</i> and <i>Ficus binnendijkii</i> / <i>alii</i>	ACD caused by <i>P. scandens</i>	ACD caused by <i>P. scandens</i>	Allergic CU caused by <i>Ficus benjamina</i> and <i>Spathiphyllum</i>	Allergic CU caused by <i>Ficus benjamina</i> and <i>Spathiphyllum</i>	Allergic CU caused by <i>Ficus benjamina</i> and <i>Spathiphyllum</i>	Allergic CU caused by <i>Ficus benjamina</i> and <i>Yucca</i>

Abbreviations: ACD, allergic contact dermatitis; acet, acetone; CU, contact urticaria; Eth, ethanol; NT, not tested; UE, ultrasonic extract.

Note: *Yucca*, *Spathiphyllum* and *Davallia* subspecies not defined.^aPatch tests in five control patients negative with *Philodendron* (*P. scandens* and *P. scandens Brasil* UEs (ethanol and acetone).^bOpen skin application tests were performed with fresh plant samples chopped into small pieces and moisturized with water, if needed.

CASE REPORT

Five of our patients had symptoms consistent with allergic rhinitis and contact urticaria while handling plants at work, and in all of them, immediate allergy to indoor plants was shown by skin prick testing (SPT). Two patients had eczema on the arms after handling plants in green walls and were diagnosed with allergic contact dermatitis (ACD) caused by *Philodendron* (*P.*) *scandens*. All the five patients examined most recently (2019–2020) were involved in the care of indoor green walls.

SPT was performed in accordance with European guidelines¹ in all patients with a baseline series of common aeroallergens and with an indoor plant series that includes in-house test substances prepared from freshly cut samples of *Ficus benjamina*, *Spathiphyllum*, *Dracaena marginata*, *Yucca*, *Asplenium*, and *Euphorbia* chopped into small pieces and moisturized with a buffer solution (potassium phosphate). If the patient provided fresh samples of plants from the workplace, SPT was performed according to the same method. In patients with eczema, patch testing was performed with Finn Chambers (SmartPractice, Phoenix, Arizona) in accordance with ESCD guidelines.² Samples of *P. scandens* provided by the patients were patch tested “as is” moistened with aqua and ethanol and as ultrasonic extracts in aqua, ethanol, and acetone.³

DISCUSSION

Of the seven plant keepers, five had developed immediate allergy, occupational allergic rhinitis, and occupational allergic contact urticaria, while two had occupational ACD caused by *P. scandens* present in indoor green walls.

Ornamental indoor plants are a well-known cause of immediate allergy.⁴ Cases of immediate allergy to *Ficus benjamina*, the weeping fig, in plant keepers as well as non-occupational cases are described in the literature.^{5,6} Immediate occupational and non-occupational allergy to other indoor decorative plants such as the spathe flower (*Spathiphyllum*), *Yucca*, *Hoya compacta* and *Dracaena fragrans* have been previously reported.^{7–10}

P. scandens, also known as the sweetheart plant or heart-leaf, is a vining pot plant of the Araceae family. The “Brasil” variety of philodendron has yellow variegated leaves. ACD caused by *P. scandens* has previously been reported in occupational and non-occupational settings since the 1950s.^{11,12} 5-Alkylresorcinols and 5-alkenylresorcinols have been identified as allergens in *P. scandens* and in other, although not in all, *Philodendron* subspecies.^{13,14} More recently, a case of a plant keeper with both immediate and delayed sensitization to *Philodendron* was reported.¹⁵

When planning patch testing of plant samples, it is important to carefully consider the irritant and sensitizing potential and to refrain from patch testing unknown plants.¹⁶ When possible, it is advisable to rely on test substances of plant allergens instead of patch testing plant samples “as is”. Unfortunately, only a limited number of plant allergens are currently available as commercial patch test substances.¹⁷

In conclusion, maintenance of indoor green walls is a task with intense exposure to a relatively small variety of pot plants. In addition to contact urticaria induced by the *Ficus* species and *Spathiphyllum*, indoor plant keepers may develop delayed sensitization to the *Philodendron* species.

AUTHOR CONTRIBUTIONS

Maria Pesonen: Conceptualization; data curation; methodology; writing-original draft; writing-review and editing. **Kristiina Aalto-Korte:** Conceptualization; data curation; methodology; writing-original draft; writing-review and editing.

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The versatile UV absorber drometrizole: Expanding from the realm of cosmetics to feminine sanitary products

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Drometrizole is an ultraviolet absorber that is used in cosmetics and occasional plastic and rubber items, which is associated with allergic contact dermatitis (ACD). In patients presenting with genital dermatitis and contact allergy to sanitary pads, drometrizole should be considered as a versatile, inconspicuous allergen with the potential to be embedded in assorted plastics.

CASE REPORT

A 55-year-old woman presented with a 3- to 4-month history of diffuse pruritic papulovesicular genital dermatitis, extending from the proximal leg and mons throughout the outer labia onto the buttocks, without involvement of the vaginal mucosa or anorectal tissue. She had a history of stress urinary incontinence, managed with daily sanitary pads (exclusively Poise daily liners) used over the past 1 to 2 years. All undergarments worn were of a pure cotton fabric and she washed with Dove Sensitive Skin bar soap. She was post-menopausal and amenorrheic. Neither triamcinolone 0.1% ointment (used twice weekly) nor a brief trial of over the counter (OTC) clotrimazole relieved her symptoms. She reported a historical sensitivity to adhesives.

Patch testing was performed to the 2019-2020 North American Contact Dermatitis Group Screening series and several supplemental series including preservatives, emulsifiers, fragrances, personal care products, adhesive acrylates, antifungals, and select home products including her pads. Final (day 7) patch test results demonstrated strong

(++) reactions to bacitracin 20% pet., drometrizole 1% pet., and adhesive portion of the Poise daily pad, as well as weak positive (+) reactions to beta hydroxy acid 2% pet. and the skin-side/fabric-side of the Poise daily pad (Figure 1). Given the strength of her reaction to drometrizole, it was hypothesized that this allergen was embedded in the plastic portion of her sanitary pad, thereby triggering her dermatitis.

To further investigate the potential presence of drometrizole in our patient's sanitary pads, the manufacturer (Kimberly-Clark Corporation, Neenah, Wisconsin) was contacted for verification of the materials used in this product. Given the proprietary status of their supplier's ingredients, we requested that specifically our patient's allergens be evaluated given the clinical significance, and the

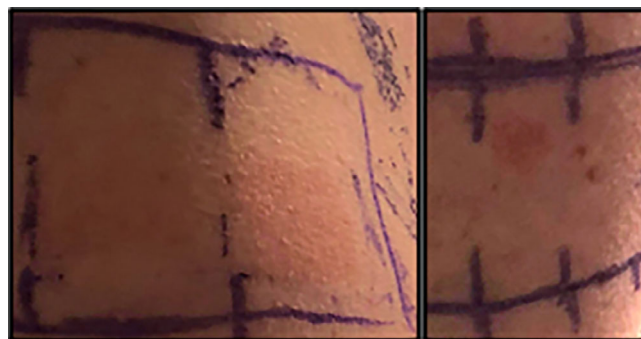


FIGURE 1 From left to right, final patch test reading for: (A) skin-side/fabric-side of the poise daily pad, (B) adhesive portion of the poise daily pad, and (C) drometrizole (1% pet.)