



Airborne allergic contact dermatitis caused by *Machaerium scleroxylon*: Confirmation by in vivo and in vitro tests

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Airborne agents can cause several skin reactions in occupational and, less frequently, in non-occupational settings, owing to their strong irritant and/or sensitizing properties.¹ Airborne allergic contact dermatitis is frequently caused by woods,² above all tropical and subtropical woods containing many strong contact allergens, such as quinones.³ A case of airborne allergic contact dermatitis caused by *Machaerium scleroxylon*, confirmed by in vivo and in vitro tests, is described.

CASE REPORT

A 60-year-old non-atopic male was referred to us because of itchy eczema initially localized on the face and neck, with an airborne contact dermatitis pattern (Figure 1A,B). Dermatitis quickly progressed to the upper chest, the folds of the limbs, and the trunk (Figure 1C,D). Dry cough and rhinorrhoea were also present. Two days later, almost the entire trunk and upper limbs were involved (Figure 1E,F). Symptoms appeared 24 hours after the patient planned a South American wood to make a guitar sound box. The patient reported that he had started to occasionally work with the wood 6 months before as his hobby. The dermatitis resolved within 1 month with oral prednisone and betamethasone dipropionate ointment.

The wood was botanically identified as *M. scleroxylon* Tul. Gas chromatography (GC) in a solid-phase microextraction/GC/mass spectrometry configuration on aqueous extracts of *M. scleroxylon* fresh sawdust showed the presence of several chemicals from the quinone family; no other chemicals were detected. Two months after resolution of dermatitis, patch tests with *M. scleroxylon* ethanolic extracts (0.1%, 1%, and 5%) were performed.⁴ Patch tests were occluded for 2 days with Haye's Test Chambers (Haye's Service, Alphen aan den Rijn, The Netherlands) on Soffix tape (Artsana, Grandate, Italy), and readings were performed according to ESCD criteria. On day (D) 2 and D4, a possibly allergic reaction (vesicular and bullous) to a 5.0% ethanolic extract of *M. scleroxylon* was observed (Figure 1G), whereas serial dilutions (1.0% and 0.1%) gave ++ positive reactions (Figure 1H,I). Patch testing with 1.0% and 0.1% *M. scleroxylon* ethanolic extracts in 10 consecutive control subjects gave negative results.

For further study of delayed hypersensitivity in vitro, T-lymphocyte activation and proliferation assays were performed. For both tests, ethanolic extracts (1:10, 1:100, and 1:1000) of *M. scleroxylon* were used to stimulate the patient's mononuclear cells, which had been previously separated and placed onto 96-cell plates. T-lymphocyte activation was evaluated with flow cytometry



FIGURE 1 A-D, Eczematous dermatitis of the face (A), neck (B), upper limb folds (C), and trunk (D). E, F, Spreading of dermatitis to the trunk and upper limbs. G-I, Patch test reactions to 5% (equivocal response) (G), 1% (++) (H) and 0.1% (++) (I) *Machaerium scleroxylon* extracts

according to CD69 expression after 3 days of incubation with the extracts.⁵ T-lymphocyte proliferation was evaluated with a carboxyfluorescein succinimidyl ester assay after 5 days of *M. scleroxylon* extract stimulation.⁶ The results of both tests were compared with those obtained with unstimulated and phytohaemagglutinin-stimulated cells. The T-lymphocyte activation test showed higher expression of CD69 with the highest concentration (1:10) of *M. scleroxylon* extract (Figure S1a), whereas the T-lymphocyte proliferation test showed a higher response to the lowest concentration (1:1000) (Figure S1b).

DISCUSSION

M. scleroxylon, also known as Pau ferro, Santos rosewood, morado, and caviuna, is an exotic wood imported from Central and South America, mostly Bolivia and Brazil. It belongs to the Leguminosae family and, being more easily available and less expensive than some of the true rosewoods (genus *Dalbergia*), it is often used as a substitute, particularly for the manufacture of furniture, parquets, veneers, musical instruments, and knife handles.⁷ *M. scleroxylon* dust produced during the mechanical wood processing can induce, mainly through airborne exposure, muco-cutaneous irritation and allergic contact dermatitis, particularly caused by R-3,4-dimethoxydalbergione and its quinol in occupational settings.^{3,8} *M. scleroxylon* is closely related to *Dalbergia* species, but is more irritant and sensitizing than *Dalbergia nigra* All. (Brazilian rosewood).⁹

Herein, we describe a rare case of non-occupational airborne contact dermatitis. After the involvement of the body areas directly exposed to the air, the dermatitis spread to cover other parts of the body in our patient, particularly the folds. This could be explained by dust trapped under clothing associated with sweat retention, and by dust inhalation causing a systemic reaction.¹ The main allergen of *M. scleroxylon*, R-3,4-dimethoxydalbergione, is a primary irritant at a concentration of 1%, and only dilutions of 0.1% to 0.01% will elicit true allergic reactions.^{9,10} Our patient was tested with an extract and not the pure allergen, and the lower concentrations gave negative results in controls, so it is probably a true contact allergic reaction. The results of patch testing with a dilution series of *M. scleroxylon* suggest that 0.1% is the optimal concentration to avoid irritant reactions, as well as active sensitization.⁹

In our case, patch test results were confirmed by in vitro tests. Activation of the T-lymphocyte response and T-lymphocyte proliferation, induced by *M. scleroxylon* extract at higher and lower concentrations, respectively, suggest that delayed-type hypersensitivity is mainly involved in this case of airborne dermatitis, which is more than a simple irritant effect caused by wood dust. In fact, in allergic contact dermatitis patients, CD69 presentation seems to be mainly involved in down-regulating Th1-mediated and Th17-mediated delayed hypersensitivity.¹¹ Moreover, the presence of T-lymphocyte proliferation in response to the lower concentrations and its absence at the highest concentration show immunoreactivity of the wood dust, and may reflect the intervention of activated T-regulatory lymphocytes, which are able to inhibit uncontrolled lymphocyte proliferation at the higher concentration.¹²

CONFLICTS OF INTEREST

The authors have no conflicts of interest to report..

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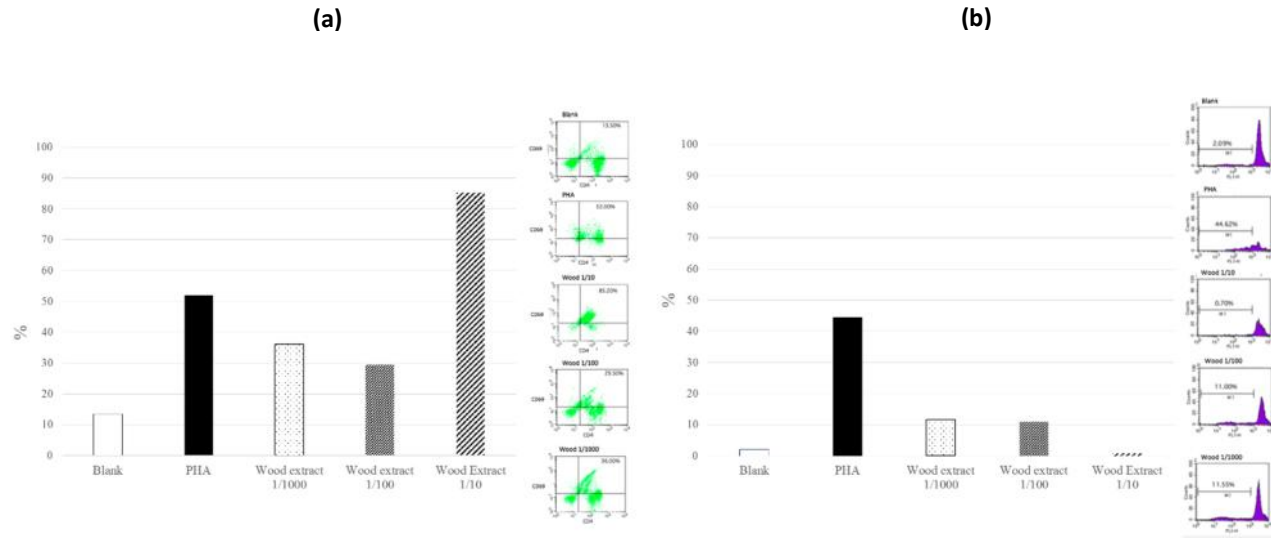
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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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Online supplemental Figure 2 T-lymphocyte activation test: higher expression of CD69 with the highest concentration (1:10) of *Machaerium scleroxylon* extract (a). T-lymphocyte proliferation test: higher responses with lower concentrations (1:1000, 1:100) of *Machaerium scleroxylon* extract (b)



Blank: unstimulated cells; PHA: phytohemagglutinin stimulated cells