

Occupational airborne contact dermatitis from *Machaerium scleroxylon*: a simple method for extracting quinones from wood

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Machaerium scleroxylon, more commonly known as morado, Pao ferro, and Santos rosewood, is a South American wood of the Leguminosae family, which is frequently imported from Bolivia and Brazil because it is less expensive than other tropical and subtropical leguminous trees, especially those of the genus *Dalbergia* (1). For this reason it is used for knife handles, ornaments, musical instruments, and billiard cues (2). *M. scleroxylon* may cause allergic contact dermatitis. Its main allergen is (R)-3,4-dimethoxydalbergione, which is the most sensitizing of the quinones or dalbergiones (3).

Case Report

A 25 year old atopic man was referred to us with a 5 month history of itchy eczematous dermatitis starting on the face and quickly progressing to the antecubital and popliteal folds, and thighs. The dermatitis improved with topical corticosteroid and oral antihis-

taminic therapy and healed when he took a break from his job but recurred when he resumed work. For 6 months the patient had been employed as a joiner in a small wood factory, where he was assigned to the manufacture of parquet tablets, which were made by cutting a number of different exotic woods (sirari, doussiè, morado, cabreuva, tatobà, iroko, wengè, teak). However, he suffered more frequent relapses when cutting *M. scleroxylon* wood or when he had indirect contact by working in an environment that contained this wood dust.

Analytical approach through gas chromatography in solid-phase micro-extraction/GC/MS configuration on watery extracts of *M. scleroxylon* fresh sawdust showed the presence of several chemicals from the quinone family and a large amount of styrene. This compound is usually painted on the wood surface to improve its acoustic property.

Patch testing with SIDAPA (Società Italiana Dermatologia Allergologica Professionale e Ambientale) standard series (FIRMA Diagent, Florence, Italy), *M. scleroxylon* ethanolic extracts (4), and styrene were performed (Table 1). Allergens were applied on the upper back with Heye's Test Chambers[®] (Haye's Service B.V., Alphen aan den Rijn, The Netherlands) on Soffix[®] tape (Artisana S.p.A., Grandate, Italy) and removed after 2 days. The readings were noted on day 2 (D2) and D4 according to International Contact Dermatitis Research Group (ICDRG) criteria. Positive reactions to *M. scleroxylon* ethanolic extracts at D2 and D4 were observed (Table 1). A delayed eczematous reaction on the site of the prick test with *M. scleroxylon* ethanolic extract was also observed (Table 1).

Subsequently, *M. scleroxylon* aqueous extraction was performed

by using the 'ultrasonic bath' method (5). 1 g of *M. scleroxylon* sawdust was suspended in 15 ml of distilled water in a closed vial of 21 ml total capacity, then dipped in a liquid medium ('sonication bath') and subjected to 40 kHz ultrasound waves for 15 min (Ultrasonic Cleaner Pinpoint, Model PT 101, Sino Science & Technology Co., Ltd, Zhangzhou City, China). This sonication time was set to obtain qualitative investigation in this screening. The suspension was subsequently filtered on paper filter Watmann-41. Patch tests with this aqueous extract (5% and 1% in aqueous) were positive.

Patch testing with *M. scleroxylon* ethanolic and aqueous extracts (1% and 5%) in 10 consecutive control patients was negative.

Discussion

Machaerium scleroxylon (Leguminosae: Papilionoideae) is an imported tropical hardwood that resembles Brazilian rosewood (*Dalbergia*) in appearance and strength (1). For these reasons it is used as a substitute for the *Dalbergia* species, although it is known to be an irritant to the oral mucosa and the upper respiratory system and a strong irritant and/or sensitizer to the skin (3). In fact *M. scleroxylon* can cause both irritant and allergic contact dermatitis mainly in woodworkers (carpenters and joiners) through airborne exposure (6). Less commonly, it provokes dermatitis in end-users of finished wood products both in occupational (perioral dermatitis and cheilitis in musicians playing flutes made of *M. scleroxylon* wood and chin rest allergy in a violinist) (3, 7) and in non-occupational environments (billiard cues) (2). Erythema multiforme-like reactions have also been reported (8, 9).

Table 1. Patch and prick test results

	%	D2	D4
Patch test			
SIDAPA standard series		—	—
<i>Machaerium scleroxylon</i> extracts (4)	1 ^a	+	++
	5 ^b	++	++
Styrene	1 ^b	—	—
Prick test			
<i>Machaerium scleroxylon</i> extract	1 ^a	++ ^c	

^aIn ethanol.

^bIn pet.

^cEczematous reaction.

SIDAPA, Società Italiana di Dermatologia Allergologica Professionale e Ambientale.

Tropical and subtropical woods contain many strong contact allergens and in particular quinones. Their presence may explain the possible cross-reactions between woods belonging to different families. The main sensitizer in *M. scleroxylon* is (*R*)-3,4-dimethoxydalbergione which is the most sensitizing of the quinones. This compound is present only in the *Machaerium* species but it may cross-react with other quinones, such as (*R*)-4-methoxydalbergione, (*S*)-4'-hydroxy-4-methoxydalbergione, and (*S*)-4,4'-dimethoxydalbergione of the *Dalbergia* species (true rosewood) (2).

Quinones, which are found in the mitochondrial and chloroplast membranes, have a protective function acting as electron carriers in the regulation of oxide-reductive equilibrium (10). They have the ability to possess both oxidative and entirely reduced states (quinols) (10). The latter state is hydrosoluble and therefore by using the ultrasound method quinones can be extracted in an aqueous vehicle. This method is quicker and less expensive than ethanolic extractive techniques. Therefore, the ultrasound method could be a valid alternative to study plant and wood hydrosoluble allergens. Moreover, the aqueous extracts cause less irritant effects than alcoholic extracts when these are patch tested (11).

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