

CONTACT ECZEMA CAUSED BY TRUE TEAK (*Tectona grandis*)

A FOLLOW-UP STUDY OF A PREVIOUS EPIDEMIOLOGICAL INVESTIGATION, AND
A STUDY INTO THE SENSITIZING EFFECT OF VARIOUS TEAK EXTRACTS

BY

H. K. KROGH

From the Department of Dermatology, School of Medicine, University of Bergen, Norway

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A follow-up study of a previous epidemiological investigation in a furniture factory concerning allergic contact eczema caused by true teak (*Tectona grandis*) clearly shows that a good educational campaign associated with specific and general prophylactic measures are able to control occupational dermatoses. At the first investigation 20.5% of the workers had allergic contact eczema and/or severe itching whereas only 8.3% suffered from the same complaints on re-examination. The different prophylactic measures previously recommended had been taken.

Patch tests with various teak extracts were made on 13 workers sensitized to teak; these showed that lapachol (a derivative of naphthoquinone) is one of the sensitizing agents in teak wood. Furthermore, allergic reactions were obtained in seven of these workers when Jacaranda wood dust containing lapachol was used as the test substance.

Two years ago an epidemiological investigation of contact eczema due to teak was undertaken at the request of the management of a furniture factory (Krogh, 1962). Out of 112 workers who were exposed to teak at their work, 21 (18.8%) showed an allergic skin reaction to native teak dust. Allergic contact eczema was diagnosed in 12.5%, and 6.3% were considered to have latent allergy, confirming that teak is a fairly potent sensitizer. The relatively high percentage of sensitization to teak among the workers was considered to be due in part to the lack of suitable prophylactic measures, and certain specific improvements were recommended.

It was our intention to have this working group re-examined in order to evaluate the results of the prophylactic measures. Furthermore, we wanted to take the opportunity to study the sensitizing properties of various teak extracts. These have been examined by a number of workers, primarily to determine the causes of teak's resistance to wood rot, fungi, and termites. Several substances have been isolated, including tectoquinone (2-methylantraquinone) and two, possibly three, related anthraquinones (anthraquinone-2-aldehyde, 2-hydroxy-methylantraquinone, and anthraquinone-2-carboxylic acid). In addition, lapachol (a derivative of naphthoquinone), 2-methoxytoluene, 2-iodo-

benzoic acid, n-heptylamine, butyric acid, tectol, dehydrotectol, and a *cis*-1-4-polyisoprene (Kafuku and Sebe, 1932; Dhamachari, 1957; Pavanaram and Row, 1957; Sandermann and Dietrichs, 1957; Rudman, Da Costa, Gay and Wetherly, 1958; Rudman and Da Costa 1959; Sandermann and Dietrichs, 1959; Rudman, 1960) have been isolated. Rudman (1961) tried to confirm the findings of Dhamachari (1957) but was not able to isolate 2-iodobenzoic acid, n-heptyl-amine and o-cresyl-methyl ether, and he doubts if they are to be found in teak.

Primarily because of the difficulties in obtaining the various compounds isolated in sufficient quantities to make a thorough investigation possible, little has been done concerning their sensitizing properties. Schulz (1961-1962) applied patch tests with some of the known constituents (lapachol, tectol, dehydrotectol, and tectoquinone) isolated by Sandermann and Dietrichs (1959). Out of four patients sensitized to teak, three showed a clearly positive reaction to lapachol whereas patch tests with the other substances were negative. Further investigations were needed to confirm these results (Schulz, 1962). It is interesting to note that other tropical woods also contain lapachol, *i.e.* members of the *Tabebuia* genus—'greenheart' and Lapacho-

wood (*Tabebuia lapacho*), Peroba do Campos (*Paratecoma peroba*), and Jacaranda (*Jacaranda brasiliensis*).

Teak is continuously considered the wood of choice in the furniture trade in the Scandinavian countries. Lately, Jacaranda also has become a popular raw material.

Method and Material

A short lecture concerning the purpose of the re-examination and further patch testing was given to the management of the factory and to the workers involved. The working conditions of the employees were inspected, and it was found that the prophylactic measures previously recommended, e.g. exhaust ventilation, protective clothing, general and personal hygiene, etc., had received attention. The workers volunteered the information that skin complaints as a whole had been much less frequent since the introduction of these measures. Except for one worker, who from previous testing knew about his hypersensitivity to teak dust and had continued to experience eczematous flare-ups whenever he was exposed to it, necessitating complete avoidance of the wood, all present workers had continued at their previous jobs. Owing to trade slackness, the working population of the factory had been reduced by a third, and a further three workers sensitized to teak had found themselves other jobs. No new workers had been appointed. This investigation covers 72 workers, who to varying degrees are exposed to teak during different working procedures.

All the 72 workers were interviewed and examined for skin lesions. Patch tests with native teak dust were applied for 24 hours on the volar side of the left forearm and read at the end of this period and read again after 48 and 72 hours. The interpretation of the patch tests was based on the usual criteria and was recorded as allergic, toxic, or negative. The workers who showed allergic reactions were also tested in the same way with the following extracts of teak; lapachol, tectoquinone, anthraquinone-2-aldehyde, and anthraquinone-2-

carboxylic acid. Acetone was used as a diluent, and the different chemical compounds were applied in the same series of concentration (0.1-0.5-1-2%). Patch tests with native Jacaranda wood dust were also applied. Identical patch tests were applied on 10 controls.

Results

In order to evaluate the result of the different prophylactic measures previously recommended, the result of previous clinical examination, history, and patch testing are tabulated together with the outcome of the re-examination and patch testing (Table 1).

All cases recorded as contact eczema were considered to be occupational, resulting from exposure to teak, except in one case where a worker had allergic contact eczema caused by a certain glue.

Table 1 illustrates the relation of the outcome of the two succeeding examinations and patch testing. At the first examination two years ago, six workers presented eczematous eruptions which had the distribution and appearance of a contact eczema resulting from exposure to dust. Furthermore, 12 workers had previously experienced eczematous flare-ups on exposure to teak dust. In all these cases there had been a close relation between the presence of the eruption and exposure to teak. All except four workers in this group showed allergic reactions to native teak dust, indicating allergic contact eczema caused by teak. Based on a retrospective analysis of the cutaneous lesions and the history, the four workers who showed negative reactions to native teak dust were considered to have developed immunity ('hardening'). Re-examination revealed that one worker still seems to belong to this category. Three workers sensitized to teak (one with contact eczema at the first examination and two workers who had previously had

TABLE 1
RESULT OF CLINICAL EXAMINATION AND PATCH TESTING WITH NATIVE TEAK
DUST OF WORKERS EXPOSED TO TEAK AND FOLLOWED FOR TWO YEARS

Clinical Category of Workers	First Examination				Result of Patch Tests with Native Teak Dust*				Total
	At Re-examination	First Examination			First Examination		Re-examination		
		Contact Eczema	Severe Itching	Previous History	No Skin Complaints	Allergic	Negative	Allergic	
Contact eczema				3	1	2	2	1†	3
Severe itching		2		1	1	2	1	2	3
Subtotal		2		4	2	4	3	3	6
Previous history of 'teak-eczema'	5		10		11	4	10	5	15
No skin complaints		14		37	5	46	4	47	51
Total	5	16	10	41	18	54	17	55	72
Workers left factory	1	1	2	36	3	37			40
Grand total	6	17	12	77	21	91			112

*Toxic reactions were not registered.

†This worker had contact eczema caused by a glue.

flare-ups of contact eczema ascribed to teak) had left the factory and could not be re-examined. None of the present workers in this group had any skin lesions when re-examined, and 10 of them showed allergic reactions to teak when tested. These 10 workers volunteered the information, however, that any relaxation in the general prophylactic measures would soon bring about itching and an eczematous flare-up of varying degree.

At re-examination only three workers showed moderate eczematous eruptions considered in two of them to be due to exposure to dust. They had never had skin complaints until the last four to six months, when they had had outbursts of eczema especially around the eyes and on the hands and wrists whenever they operated machines producing teak dust. One of them had at the first testing shown an allergic reaction to native teak dust, but he was then considered to have a latent allergy. The other showed no reaction when previously tested. Further patch testing clearly revealed sensitization to teak. The third worker in this group showed a negative reaction to teak dust when tested. The localization and distribution of the eczematous lesions, together with the history and his working procedures, made some other contactant more likely. Patch tests with other possible potent sensitizers revealed sensitization to a certain glue, an epoxy resin.

Severe itching was much less frequent at re-examination. When examined two years ago, 17 workers complained of severe itching on exposure to teak dust, whereas only three workers had this complaint on re-examination. One of these workers showed an allergic reaction to teak dust but was considered to have a latent allergy. In the remaining two workers in this group the symptom may be ascribed to the mechanical effect of the dust. At the previous patch testing seven workers were considered to have a latent allergy (two workers with severe itching and five with no skin complaints). One of these workers has since developed a manifest allergy as an allergic contact eczema. In one case the patch test was negative at re-examination and therefore probably false positive at the primary testing. The others may still be considered to have a latent allergy.

Table 2 shows the result of patch tests applied with lapachol and native Jacaranda dust. The other teak extracts applied were all negative and the results were therefore left out of the table. Two workers refused to have further patch tests applied because of severe reactions with focal flare-ups at the previous testing. Allergic reactions were registered in nine cases when patch tests with 2% lapachol were used. Seven of these workers presented clearly positive, but weaker reactions to lapachol 1%, while

TABLE 2
RESULT OF PATCH TESTS WITH NATIVE JACARANDA DUST AND DIFFERENT EXTRACTS OF TEAK WOOD ON 13 WORKERS SENSITIZED TO TEAK

Test Substance*	Allergic	Toxic	Negative	Total
Lapachol				
0.1% (acetone)	0	0	13	13
0.5% (acetone)	3	0	10	13
1% (acetone)	7	0	6	13
2% (acetone)	9	0	4	13
Jacaranda dust	7	0	6	13

*Patch tests applied with 2-methylanthraquinone, anthraquinone-2-aldehyde, and anthraquinone-2-carboxylic acid were all negative.

three showed a more uncertain reaction to a 0.5% dilution of lapachol. An allergic reaction was also registered in seven men when native Jacaranda dust was used as the test substance. None of these workers had ever been exposed to Jacaranda wood as far as they knew. The controls showed negative reactions to all patch tests applied. Toxic reactions were not observed.

Discussion

This re-examination clearly shows the importance of a good educational campaign and general prophylactic measures in preventing occupational dermatoses. During the last two years there have been only three new cases of allergic contact eczema, two of which were due to teak and one was caused by an epoxy resin glue. At the first investigation 20.5% of the workers had contact eczema and/or severe itching, whereas at re-examination only 8.3% were so affected. Considering that a greater proportion of the workers (23.6%) is sensitized to teak than was the case two years ago (18.8%), the decreased frequency of skin complaints is still more noteworthy. The increase in the percentage of sensitized workers is due to the fact that none of these workers was given notice when the factory had to cut down its labour force. This was because they were highly skilled and specialized craftsmen. Three workers, however, who were sensitized to teak, and who had suffered severe exacerbations of contact eczema on exposure to teak dust, had left the factory voluntarily to get themselves other jobs.

It seems possible that workers not too heavily sensitized to teak may keep on with their jobs provided that all prophylactic measures are taken. Furthermore, possible desensitization and development of immunity or 'hardening' are factors that must be taken into consideration before deciding whether a worker should be kept at his work or taken off his job immediately.

The investigation concerning the sensitizing effect of some extracts of teak confirms the conclusion of Schulz (1962) that lapachol is one of the sensitizing agents in teak. The possibility that still other sub-

stances in teak may act as potent sensitizers needs further study. From a practical point of view, it seems obvious that workers sensitized to teak may develop allergic contact eczema when exposed to Jacaranda wood as well as to other wood species containing lapachol.

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