

Contact allergy due to lichens in patients with a history of photosensitivity

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Ten patients with a history of photosensitivity and of a rash showed abnormal reactions to long-wave UVR. The rash occurred particularly in areas exposed to light, though other areas were occasionally involved. The development of the rash could in all patients be related to contact with lichens and although exposure to sunlight usually led to an aggravation of symptoms, some patients, particularly forestry workers, showed exacerbations even during the winter. Positive responses were observed in both irradiated and non-irradiated patch tests with different species of lichen and in several patients irradiation precipitated a stronger response. These findings suggest that lichens can cause both contact and photocontact dermatitis. The suspected allergens contained in these lichens are atranorin, physodalic and pysodic acids.

Key words: Contact dermatitis – lichen – photosensitivity – plant dermatitis.

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There are few reports of contact dermatitis due to lichen allergy. It is probable that other cases have remained unexplained or misdiagnosed owing to difficulty in tracing the responsible allergens. Direct contact with lichens is probably the primary cause of sensitisation although the possibility of airborne contact cannot be excluded. The usual areas of involvement are the face, neck, hands and forearms although the changes may extend to the genitalia, around the waistline, and other areas where the allergens accumulate (Champion 1965).

A lichen is a symbiotic association between a fungus and an alga and can be found on a wide variety of trees, rocks and in soils (Mitchell & Armitage 1965). In fact, the term "woodcutters eczema" has been used to describe allergic dermatitis in for-

estry workers (Mitchell 1965). However, lichens are also to be found in an urban environment, for example in firewood, table decorations, funeral wreaths, etc.

The offending allergens are water and fat soluble, very resistant and can survive in dried plants for several years (Le Coulant & Lopes 1956). In particular lichenic acids, including usnic acid, have been suspected as a cause of allergic contact dermatitis in man (Mitchell 1966), although other related substances have been shown to possess immunological activity (Mitchell & Shibata 1969). Usnic acid is a dibenzofuran and is chemically related to furocoumarans (psoralens).

This report concerns 10 patients who presented with a history of apparent photo-dermatitis on light-exposed areas. However,

Table 1. Duration of symptoms in relation to occupation and hobbies in 10 patients with photosensitivity

Patient	Age (yrs)	Duration of symptoms (yrs)	Occupation/Hobbies
M. F.	67	1½	Gardening
L. K.	58	10	Gardener's wife ¹
L. L.	47	4	Forest surveyor's wife ¹
R. Aa.	74	10	Gardening
M. P.	50	2	Teacher: botany/geology
K. L.	47	12	Farmer, forest worker
G. R.	56	25	Road labourer
P. S.	79	40	Railway labourer
O. W.	37	4	Road labourer/hunting
E. G.	57	6	Farmer

¹ Exposure to the materials occurred mainly by visiting the work places of the husband.

several patients mentioned that this apparent photosensitivity was aggravated or initiated following forestry or horticultural work. We are currently examining all our photosensitive patients for possible allergy to various lichens using both patch and photopatch tests.

Materials and Methods

The patient material consisted of four females and six males all with a history of apparent photodermatitis. Table 1 shows the duration of symptoms together with occupations and hobbies.

Case Reports

Case 1: M.F., female, aged 67 years, presented with a rash localized on the face, neck, hands and forearms which had first appeared about 6 months earlier following

several days of berrypicking in hot sunny weather. From time to time there was involvement of other parts of the body including the lower extremities. Although the condition is aggravated by sunlight she also reported exacerbation during the winter.

Case 2: L.K., female, aged 58 years, presented with a rash that had started 10 years ago on the face and has since spread to involve all light-exposed areas. She is symptom-free during the winter months but in the summer she must avoid sunlight and can no longer help her husband who is a gardener.

Case 3: L.L., female, aged 47 years, is married to a forester and her rash which first appeared 4 years ago is aggravated by exposure to sunlight. Sunlight provoked eczema on the body even on areas covered by thin clothes. Although originally confined to the hands and forearms the condition now involves the face, neck and from time to time even lower areas of the body. Contact with firewood precipitates eczema of the hands.

Case 4: R.Aa., male, aged 74 years. His rash started 10 years ago involving the face, neck and hands although areas of the trunk not normally exposed were sometimes affected. The symptoms were aggravated by exposure to sunlight and although the condition generally resolved in the winter, contact with foliage of various trees caused a reaction.

Case 5: M.P., female, aged 50 years. Her rash is localised on the hands and face and first appeared 2 years ago; although the condition was aggravated by sunlight she had also had periods of eczema in the winter months. She is a teacher by profession and her hobbies include geology,

botany and the making of decorations from materials such as stones and twigs.

Case 6: K.L., male, aged 47 years, is a farmer and forestry worker and first noticed the rash in December 12 years ago following a period of forestry work. The affected areas were mainly the face and hands with some involvement of the forearms, and although worse in the summer months the condition did not resolve in the winter. The skin had become lichenified in the affected areas.

Case 7: G.R., male, aged 56 years, although a labourer by trade, his rash first started following a period of forestry work 25 years ago. The areas of involvement are mainly the face and hands. Symptoms include weeping dermatitis and considerable oedema around the eyes. Exposure to sunlight led to a deterioration of the condition.

Case 8: P.S., male, aged 79 years is a retired railway employee with a history of dermatitis stretching back 40 years. His first hospitalization for photodermatitis was 32 years ago and he himself attributed his problems to contact with wooden railway sleepers. He is symptom-free during the winter.

Case 9: O.W., male, aged 37 years, is a road labourer with a 4-year history of dermatitis which at first affected the face but later spread to both upper and lower extremities. Aggravated by exposure to sunlight, the symptoms were more pronounced in the summer; exacerbations occurred in the winter, however, particularly following skiing or hunting trips in forest areas.

Case 10: E.G., male, aged 57 years, is a farmer whose rash first appeared on light-exposed areas some 6 years ago. The condition later spread to the groin and although

aggravated by sunlight, symptoms appeared periodically in the winter months.

Investigations

Light testing

All patients were tested for light sensitivity on the back by means of the Osram High Pressure Xenon Arc Lamp (XBO 150 W) equipped with appropriate Schott filters. The thickness of the filters was KG1, 2 mm; WG320, 3 mm; UG5, 2 mm; 360 (UG1), 3 mm. Distance from lamp to skin was 20 cm and the test areas 10 mm in diameter. For long ultraviolet radiation (UVR) the following combinations were used: KG1 + WG320 + UG5 (half band width 350–390 nm), KG1 + WG320 (half band width 345–745 nm), filter for 360 nm: UG1 (half band width 345–380 nm).

The energy output was measured with a Hewlett & Packard Radiant Flux Meter. The results were read at 24 and 48 h and the positive responses were graded as erythematous or papular reactions in the test area.

Patch testing

The lichens were collected from various trees including spruce, birch, juniper, roan, apple, cherry and blackcurrant bushes. Preliminary testing was carried out using dried lichens in a petrolatum vehicle applied to Al-test® patches (Imeco, Astra, Sweden) and secured by porous adhesive tape (Scanpor®, Norgesplaster A/S, Oslo, Norway). The method was later improved and in the present tests we employed acetone as vehicle. The patch tests were applied in duplicate on the back and the test sites examined at 48 h. The responses were graded as follows: 0 = no reaction, + = erythema, ++ = erythema with moderate oedema, +++ = erythema with early vesiculation. Following removal of the patch tests at 48 h one set was irradiated with

UVA light while the other set was covered with light-proof black paper. The irradiation apparatus consisted of six Philips TL 20 W/08 black light tubes. At a distance of 20 cm from the tubes the irradiance was 0.7 mW/cm² as measured by the Hewlett & Packard Radiant Flux Meter. Exposure time was 30 min at a distance of 20 cm from the skin giving a total dose of 1.2 J/cm². Following irradiation the patches were left uncovered but, as all patients were tested during the winter, they were always dressed in thick light-proof clothes. The reactions were read again 48 h after irradiation and the responses graded according to the above scale.

The results were interpreted as follows: A pure contact dermatitis will produce more or less equal responses in both the irradiated and non-irradiated patches. A stronger reaction in the irradiated patch would suggest a combination of contact and photocontact dermatitis. A reaction on the irradiated patch alone is indicative of a photocontact dermatitis.

Results

Table 2 shows the results of light tests with long UVR in 10 patients with photosensitivity at 24 h after irradiation. Two patients were extremely sensitive to UVA and showed a papular response to very low doses, 7.2 J/cm² (360 nm filter) and 8.4 J/cm² (KG1 + WG320 + UG5 filter combination), respectively. The other patients reacted with erythema after doses of 16.0 J/cm²–32.4 J/cm² (KG1 + WG320 filters) and after doses of 16.8–27 J/cm² (KG1 + WG320 + UG5 filter combination).

It appeared that patch tests with lichens from different sources caused positive responses in all 10 patients. In three patients a biopsy was taken of a positive patch test and histological examination showed spongiosis in the epidermis and perivascular lym-

Table 2. Results of light tests with long UVR in 10 patients sensitive to lichens

Pa-tient	Filter combination	Minimal dose J/cm ²	Response at 24 h
M. F.	KG1 + WG320	16.8	Erythema
L. K.	360 nm	7.2	Papule
	KG1 + WG320		
L. L.	+ UG5	16.8	Erythema
	KG1 + WG320		
R. Aa.	+ UG5	10.8	Erythema
M. P.	KG1 + WG320	16.0	Erythema
K. L.	KG1 + WG320	32.4	Erythema
	KG1 + WG320		
G. R.	+ UG5	21.6	Erythema
	KG1 + WG320		
P. S.	+ UG5	21.6	Erythema
	KG1 + WG320		
O. W.	+ UG5	8.4	Papule
	KG1 + WG320		
E. G.	+ UG5	27.0	Erythema

phocytic infiltrate in the dermis. The degree of responses to patch tests and photo patch tests is illustrated in Table 3. In six patients stronger reactions were produced by irradiation of the patch sites.

Controls. Patch testing with the same lichens was also performed in 10 healthy persons and in 41 other patients with light sensitivity. In three patients a weak irritant reaction was observed on both irradiated and non-irradiated sites.

Discussion

In the present study patch testing with lichens was performed in patients having a history of dermatitis on light-exposed areas which simulated photodermatitis. A history of photosensitivity was obtained in all 10 patients and all showed reactions to long UVR. Two patients had a 2+ reaction to very low doses of UVA which must be considered as abnormal. On the other hand

Table 3. Results of patch tests and photo patch test with lichens in 10 patients with photosensitivity

Patients	Patch test	Photo patch test
M. F.	+	+++
L. K.	+	++
L. L.	+	+
R. Aa.	+	++
M. P.	+	++
K. L.	+	+
G. R.	+	+
P. S.	+	++
O. W.	++	++
E. G.	+	++

some normal controls may react with erythema to UVA from the doses given in this study (Volden & Thune 1977).

The lichens most commonly observed on forest trees in Norway appear to be *Hypogymnia physodes*, *Hypogymnia tubulosa*, *Pseudovernia furfuracea*, *Physcia tenella* and *Parmelia sulcata*. *Xanthoria parietina* containing parietin has also been identified but was not tested in this study. The suspected allergen (s) seems to be atranorin and possibly physodic acid or physodalic acid (Table 4). Unfortunately these substances were not obtainable and their sensitizing properties could not be confirmed.

Table 4. Lichens causing positive patch tests in 10 patients with photosensitivity

Lichen	Chemical substances
<i>Hypogymnia physodes</i>	Physodic acid, atranorin, physodalic acid
<i>Hypogymnia tubulosa</i>	Physodic acid, atranorin
<i>Parmelia sulcata</i>	Salazic acid, atranorin
<i>Pseudovernia furfuracea</i>	Physodic acid, atranorin
<i>Physcia tenella</i>	Atranorin

Depsides derived from lichenized fungi have been shown to be immunologically active (Mitchell & Shibata 1969). Atranorin, evernic acid and perlatolic acid have, in addition to d-usnic acid been shown to give positive responses when patch tested. It was postulated that the "whole" molecule of d-usnic acid is a prerequisite for immunological activity.

Forestry workers may have allergic contact dermatitis to the liverwort *Frullania* (*Jubilacea*) and the responsible allergen is presumably a sesquiterpene lactone. It is possible that several of the patients also react to plants of the family Compositae which contain sesquiterpene lactones (Mitchell et al. 1972).

It is possible that there may be a coincidental sensitization to related and/or non-related allergens in patients presenting with a dermatitis on exposed/non-exposed areas simulating photodermatitis or airborne contact dermatitis. Another possibility is concomitant immediate and delayed type allergy which does occur in some patients with similar lesions (Champion 1971). Isolation of, and further testing with, the responsible allergens will probably reveal that this type of allergy is not at all rare.

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