

Occupational rhinoconjunctivitis and asthma caused by *Tetranychus urticae* (red spider mite). A case report

J. DELGADO, E. GÓMEZ, J. L. PALMA, J. GONZÁLEZ,
F. J. MONTESEIRIN, A. MARTÍNEZ*, J. MARTÍNEZ* and J. CONDE

Servicio regional de Inmunología Alergia. Hospital Universitario "Virgen Macarena", Sevilla and

*Departamento de I+D. Laboratorios IFIDES-ARISTEGUI, Alameda de Urquijo, 27. 48008 Bilbao, Spain

Summary

This paper highlights a clinical case of a patient suffering bronchial asthma and rhinoconjunctivitis due to sensitization to *Tetranychus urticae* (TU), commonly known as the red spider mite, which belongs to the *Prostigmata* sub-order of the *Tetranychidae* family, in relation to a work environment (a carnation nursery). Both prick and intradermal skin tests were positive, as well as specific bronchial challenge tests with TU extract. Specific IgE was demonstrated by RAST (Class 3). Unspecific bronchial provocation with methacholine was negative. Sodium dodecylsulfate-polyacrylamide gel electrophoresis (SDS-PAGE) immunoblotting revealed the presence of seven main IgE binding proteins, the more intense bands being those appearing at 21, 17 and 15 kDa. This indicates a case of immediated type hypersensitivity to *Tetranychus urticae* with a clear correlation to occupational environment.

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Introduction

Tetranychus urticae belongs to the *Acari* order, sub-order *Prostigmata*, *Tetranychidae* family. *T. urticae* specimens are cosmopolitan and polyphagus mites, found as parasites both in fruit trees and herbaceous plants, particularly in greenhouse cultures, due to their ability to proliferate in warm, humid environments.

Oval-shaped female adult mites are usually 0.5 mm long, male specimens at 0.3 mm being slightly smaller with a narrower body, and a tapered abdomen. The legs of the male *T. urticae* are proportionally shorter. Both present a diverse coloration, ranging from yellow to green, blood-orange to scarlet, with two dark spots on the dorsal, although the male exhibits a paler coloration [1].

The ideal temperature for their optimal development lies between 23 and 30°C. When parasitizing plants, one of the first signs observed is the appearance of noticeable dots on both sides of the leaves. Soon after, the presence of spiders and their cobwebs are detected.

To our knowledge, there are only two published papers to date demonstrating *T. urticae* mites as causative agents of allergic diseases [2,3].

Correspondence: Dr J. Delgado, Villegas y Marmolejo, 7-1°C, 41005 Sevilla, Spain.

The aim of the present study was to report a case of immediate hypersensitivity to *T. urticae* mite, with demonstration (and molecular weight characterization) of specific IgE to some of the protein components from the extract.

Case report

A 23-year-old male non-smoker, suffering recurrent episodes of ocular erythema, eye and nose itching, watery rhinorrhea, sneezing fits and nasal congestions, coughing, wheezing, dyspnoea, shortness of breath and prechordal tightness without fever, during the last 5 years, all exacerbated by his employment in a carnation greenhouse. He showed no indications of skin lesions. These symptoms decreased considerably at weekends and holidays. He himself correlated the severity of symptoms with the amount of *T. urticae* mites in his work environment.

Materials and methods

The preparation of *T. urticae* extract was as follows: The source material, carnation leaves parasitized by red spider mites, was provided by the patient himself. Aqueous soluble proteins were extracted from mite bodies by the

procedure described by Subiza *et al.* [4]. Extraction was carried out by magnetic stirring after adding 1 mg of red spider specimens to 10 ml PBS (phosphate-buffered saline).

Cutaneous tests were performed on the patient and 16 control subjects (this group included eight subjects with hypersensitivity to pollen and mites, three were sensitized to grass pollens, one to dog epithelia and the remaining four subjects were not allergic).

Skin-prick tests were done with the TU extract (10% w/v) and a commercial battery (IFIDES-ARISTEGUI, Bilbao, Spain) of common aeroallergens including: *Dermatophagoides pteronyssinus*, *D. farine*, *Acarus siro*, *Lepidoglyphus destructor*, *Gohieria fusca*, *Tyrophagus putrescentiae*, cockroach (*Blatella germanica*, *Blatella orientalis*, *Periplaneta americana*), dog and cat epithelia, pollen from wild grasses, cultivated grasses, *Olea*, *Chenopodium*, *Parietaria*, *Artemisia*, *Plantago*, *Helianthus*, *Platanus* and two moulds (*Cladosporium* and *Alternaria*). Fifty per cent (w/v) glycerinated saline solution and 10 mg/ml histamine phosphate and 0.9% normal saline were used as positive and negative skin-test controls. After 20 min large diameter weals, induced by allergens, were measured. Skin-test results were considered positive when such a diameter was equal to or higher than the one produced by histamine control.

Intradermal tests were also performed with the TU extract (at 1/10 000 w/v), using histamine dihydrochloride, at the same concentration, as positive control and 0.9% saline as negative one.

Skin-prick test with *Tetranychus urticae* extract was also assayed on the 16 control subjects involving 12 atopic (eight of them sensitized to home dust mites) and four non-atopic subjects.

Total IgE was estimated by the fluorescent allergosorbent test FAST (3M Ricker, St Paul, Minn. USA). Specific IgE determination was achieved by the CAP System technique (Kabi-Pharmacia, Uppsala, Sweden) testing the allergens assayed by skin-prick test. Specific IgE to TU extract was estimated by RAST, after coupling the mite proteins to BrCN activated paper discs.

SDS-PAGE and immunoblotting were performed in 12.5% polyacrylamide gels according to standard procedures. Chromogenic immunodetection of IgE binding proteins was carried out as described previously [5].

Unspecific hyperreactivity testing was done during an asymptomatic period in the patient with methacholine by the abbreviated Towley method [6], by means of a spirometer (Erich Jaeger; Germany) connected to a pneumotacograph. Methacholine concentrations of 25 mg/ml and 5 mg/ml were used, with PBS as control solution. Dilutions were administered by means of a Hudson 1720 nebulizer.

The bronchial provocation test was carried out as described by Losada *et al.* [7], recording FEV₁ (forced expiratory volume after 1 s), and FVC (forced vital capacity) at 5 min interval during the first 30 min, and every 10 min during the subsequent 30 min. Later recordings were taken at 1 h intervals, for the next 8 h to detect and treat any possible late responses.

Bronchial challenge was performed the following day after the methacholine bronchial hyperreactivity test. Dilutions were inhaled at 24-h intervals until a sustained 20% decrease FEV₁ with respect to the one obtained by inhalation of diluent was recorded. Concentrations used were: 1/10 000; 1/1000; 1/100 and 1/10 (w/v). *T. urticae* extract used was from the same batch as the one used for the skin-prick test.

Results

The subject exhibited negative cutaneous response during the skin-prick assay to all the commercial pneumoallergens tested and a positive reaction to TU extract (mean weal diameter of 12 mm). Positive control caused a weal of 6 mm diameter. The intradermal test also showed positive (mean weal diameter of 5 mm) to TU extract at 1/10 000 dilution. Positive control also elicited a weal of 15 mm diameter. The negative control did not produce a cutaneous response by skin-prick or intradermal tests in the subject under study. All the control subjects presented negative results to TU extract both by skin-prick and intracutaneous tests.

An unspecific bronchial hyperreactivity test with methacholine by the abbreviated Towley method [6] was negative. Bronchial provocation test with TU extract performed in the patient produced the following: 7 min after inhalation of 1/10 000 dilution, the patient showed a conjunctival erythema, epiphora, sneezing and watery nasal discharge, however, spirometric parameters did not vary. They also remained unmodified after inhalation of 1/1000 and 1/100 dilutions. However, 20 min after inhalation of the extract at 1/10, the patient had a 21% decrease in FEV₁ with subsequent recovery to basal recordings and further 23% decrease 5 h later.

Total IgE was estimated as 300 kU/l. Specific IgE was negative for all the aeroallergens except TU extract which yielded a positive result of 10 PRU/ml (RAST class 3).

SDS-PAGE of TU extract exhibited a complex pattern, where at least 17 protein bands could be detected, the five more intense ones being those at 39, 28, 16, 15 and <14.4 kDa. By SDS-PAGE immunoblotting technique, seven IgE binding bands were detected, with the enzymatic technique used, with molecular weight values ranging from 55 to 12 (extrapolated) kDa, three bands, at 21, 17 and 15 kDa showing the higher binding of IgE (Fig. 1).

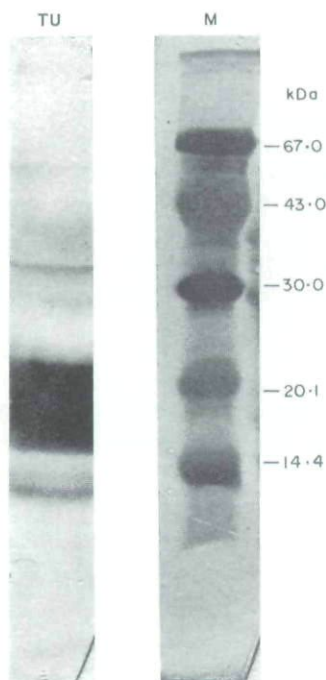


Fig. 1. SDS-PAGE immunoblotting of TU extract (TU) and molecular weight markers (M) after respective immunochemical and amido black stainings.

Some of them were scarcely detected in the protein staining of SDS-PAGE.

Control serum from non-atopic patients did not demonstrate IgE binding to *T. urticae* extracts, thus indicating the specificity of positive signals (pattern not shown).

Discussion

Mites are among the most frequent causative agents of immediate hypersensitivity. In particular, house dust mites (*D. pteronyssinus* and *D. farinae*) are the most commonly involved species [8]. Sensitization to storage mites (*A. siro*, *L. destructor*, *G. fusca*, etc.) not belonging to the *Pyroglyphidae* family, though not so prevalent, has been demonstrated and reported in many papers, especially during the last 5 years [9]. Both groups, house dust and storage mites, belong to different superfamilies of the *Astigmata* sub-order. Many studies trying to prove some degree of crossreactivity as a result of such phylogenetic relatedness have been also published.

Tetranychus urticae, besides its taxonomical differences presents its own morphological, ecological and biological features. The present study reports a case of occupational rhinoconjunctivitis and bronchial asthma due to a macroscopic mite without taxonomical relatedness to those most commonly found as allergens. Although some

authors [10,11] have reported the existence of crossreactivity between *T. urticae* (and the related *Panonychus ulmi*) and *Dermatophagoides pteronyssinus* by means of skin-prick tests, we have not encountered it.

It is particularly remarkable that the M_r determinations of IgE binding proteins of the *T. urticae* extract are different from those known for the allergens of *D. pteronyssinus* [12].

There are a couple of references quoting the implication of this mite as source of allergic pathologies [2,3,10,11] but in both cases, involvement of IgE is not sufficiently evidenced.

It is worthwhile mentioning that although there seems to be no relationship between the severity of symptoms suffered by the patient and his bronchial hyperreactivity to methacholine, a close correlation exists between symptoms and specific bronchial response, cutaneous sensitivity and RAST.

To date, two papers have been published dealing with allergy to a different red spider mite: *Panonychus ulmi*, which belongs to the *Tetranychidae* family [13,14]. In the latter reference, Kroidl *et al.* [14] have shown a case report of type I hypersensitivity to *P. ulmi*. They demonstrate IgE mediation and describe allergens by immunoprinting, however, they use isoelectrofocusing and subsequent immunoblotting to characterize them, which makes comparison with the SDS-PAGE results shown in the present paper incompatible.

In the case reported here, the patient was advised to avoid exposure to the allergen, and one year after leaving his employment, remained asymptomatic.

In conclusion, this constitutes an evident case of IgE mediated occupational rhinoconjunctivitis and asthma caused by immediate hypersensitivity to a macroscopic mite, taxonomically different from the species commonly involved in respiratory allergy. Accordingly, exposure to mites of agricultural importance, although not common in the literature, is likely to be a widespread cause of allergic reactions amongst agricultural workers which could be attributed to pollen or moulds rather than plant-inhabiting mites. The prevalence of this form of sensitization thus appears as an interesting objective for a further study.

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