

Prevalence of sensitization to *Tetranychus urticae* in greenhouse workers

A. M. NAVARRO*, J. DELGADO†, M. C. SANCHEZ*, J. C. ORTA*,
A. MARTÍNEZ‡, R. PALACIOS‡, J. MARTÍNEZ‡ and J. CONDE†

*Unidad de Alergia, Hospital El Tomillar, Sevilla †Servicio Regional de Inmunología y Alergia,
Hospital Virgen Macarena, Sevilla and ‡Departamento I+D Laboratorios Bial-Aristegui, Bilbao, Spain

Summary

Background *Tetranychus urticae* (TU) is a macroscopic mite which infests a large number of plants of economic interest worldwide. It has recently been described as a cause of occupational allergic disease in greenhouse workers. However, there are no epidemiological data concerning the prevalence of TU allergy in an unselected exposed population.

Objective The aims were to study the prevalence of TU sensitization among greenhouse workers and its relationship to the working environment and to personal factors.

Methods We studied 246 consecutive greenhouse workers, recruited directly from the field. A clinical and epidemiological questionnaire, a skin-prick test (SPT) to TU and common allergens and TU-specific IgE (RAST) determinations were performed. Seventy-five healthy volunteers and 152 atopic patients were used as a control group.

Results The prevalence of a positive SPT to TU was of 25%. Forty-five workers (19%) were TU-allergic, occurring more often in atopic greenhouse workers ($P < 0.0001$). Seven per cent showed asymptomatic sensitization. The time of exposure to TU was significantly greater in the TU-allergic patients ($P < 0.05$). The probability of sensitization to TU was 3.7 times greater in exposed than in non-exposed subjects ($P < 0.0001$).

Conclusions In this study, the prevalence of TU sensitization was 25%. There were significant associations with TU allergy and atopy and the time of exposure to TU.

Keywords: epidemiological study, greenhouse workers, occupational allergy, *Tetranychus urticae*

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Introduction

Tetranychus urticae (TU) is a macroscopic mite (commonly known as red spider) which usually parasitizes fruit trees, herbaceous plants and greenhouse crops worldwide. TU has been considered the cause of occupational IgE-mediated disease in greenhouse [1,2] and outdoor farm workers [3,4]. We have recently described the importance of this sensitization in symptomatic greenhouse workers [5]. There are no epidemiological data, however, on the prevalence of TU allergy in unselected exposed populations. The objectives of this study were to examine the prevalence of TU

hypersensitivity in a population of greenhouse workers and the risk factors associated with TU allergy.

In our transverse study, 246 consecutive greenhouse workers, recruited directly from greenhouses, were investigated through a clinical questionnaire, skin-prick and *in vitro* tests. A high prevalence of TU hypersensitivity in greenhouse workers has been established.

Materials and methods

The group studied consisted of 246 consecutive greenhouse workers from an agricultural co-operative. They had all begun working at the co-operative at least a year previously. Written informed consent was obtained from all subjects.

Correspondence: A. M. Navarro, C/Doctor Relimpio 6, 3^oB, 41003 Sevilla, Spain.

The study was approved by the ethical committee of our hospital.

Each patient's medical history was obtained through a questionnaire during a personal interview, performed by a trained interviewer. Questionnaire items included information about the type of culture (flowers or vegetables), TU recognition in the occupational environment, the length of time working in the greenhouse and duration of exposure to TU each year, symptoms suggesting an IgE-mediated allergy (asthma, rhinitis, urticaria) related to greenhouse work and with exposure to TU, date of the first reaction to TU, frequency and nature of reactions and the presence of other concomitant allergies.

The participants included 104 (42%) females and 142 (58%) males, with a mean age of 33.16 years (range: 20–46 years). They had been working in the greenhouse for a mean period of 6.57 years (range 2.4–10.7 years). Most of them (93%) recognized TU as a commonplace plague in their occupational environment. Seventy-five consecutive nonatopic and 152 consecutive atopic TU-unexposed subjects collected from our outpatient clinic were used as control group.

Skin-prick tests (SPT) were carried out according to the Subcommittee on Skin Tests of the European Academy of Allergology and Clinical Immunology (EAACI) recommendations for epidemiological studies [6], with a commercial battery of common inhalant allergens (mites, animal dander, fungi, pollen) (ALK Abelló SA, Madrid, Spain) and a TU extract prepared in our laboratory, as described previously [5]. A subject was considered to be atopic if there was a positive skin reaction to one or more common allergen extracts. Using Bradford's method, the protein concentration to the TU extract was 21%. It was homologated with our reference extract [5] through RAST inhibition and was used for skin-prick tests at a concentration of 2 mg/mL.

Specific IgE to TU extract was estimated by RAST [5]. A value greater than 0.35 PRU/mL was considered positive. Specific IgE was performed in subjects referring with allergic symptoms in the greenhouse, in those who had a positive SPT to TU without symptoms and in 25 asymptomatic workers with a negative SPT to TU.

Statistical evaluation was carried out with the SPSS software package. The chi-square test and non-parametric tests were used. The significance level was 0.05.

Results

Analysis of the questionnaire answers revealed that 69 workers (28.5%) reported symptoms suggestive of allergic disease in the greenhouse. According to the specific question asked in the clinical questionnaire, 42 (61%) reported having worsened in relationship to TU exposure.

Results of SPT with TU extract are summarized in

Table 1. Symptoms and skin-prick test to TU in greenhouse workers group

	TU prick (–)	TU prick (+)	Total
Greenhouse symptoms	24	45	69
No greenhouse symptoms	156	16	172
Total	180	61	241

Table 1. SPT was assessed in 241 subjects (5 subjects showed dermographism). A positive response was found in 61 (25%), 16 of whom showed monopositive SPT to TU, the rest showing positive SPT to other common allergens (mites, 29; pollens, 27; animal danders, six; alternaria, one).

Forty-five of 241 workers (19%) reported suggestive allergic symptoms and had a positive SPT to TU; therefore they were considered to be TU-allergic (TUA) subjects. The symptoms were compatible with rhino-conjunctivitis ($n = 43$), asthma ($n = 17$) and urticaria ($n = 12$). Seven per cent ($n = 16$) showed asymptomatic sensitization (Table 1).

There were no significant differences according to age, sex and the type of crop in the TUA and non-TU-allergic (NTUA) groups (Table 2). The time of exposure to TU was significantly greater in the TUA (7.24 years) in comparison to the NTUA (6.42 years) ($P < 0.05$). Forty-two subjects realized that they had worsened due to TU, and were more frequently documented among TUA patients ($P < 0.0001$) (Table 2).

Eighty workers (32%) of the total group of 246 participants were atopic, whereas 36 (80%) of the 45 subjects of the TUA group were atopic. Therefore, patients who were TUA were significantly more likely to be atopic than those who were NTUA ($P < 0.0001$) (Table 2).

Sixty of the 61 subjects with a positive SPT agreed to a blood analysis. RAST was found positive in 24 of the TUA group (53%) and in five (33%) workers with a positive SPT to TU, although asymptomatic. RAST was negative in the remaining workers and in the control group.

In 75 nonatopic controls, the SPT to TU was negative in all cases. Of 152 atopic controls, a positive SPT was found in 19 patients (11 were sensitive to mites, five to animal epithelia, three to fungi and 19 to pollens); however, all of them showed negative results for specific IgE to TU.

Among 152 atopic controls, 68 subjects showed a positive SPT to house dust mites while only 11 subjects had a positive SPT response to TU.

After analysing skin sensitization to TU, both in exposed and in control groups (Table 3), it was found that the

Table 2. Comparison between the clinical features of the TUA and NTUA groups

	TUA	NTUA	<i>P</i> -value
All (<i>n</i>)	45	196	–
Age groups			NS
<20	16 (36%)	36 (18%)	
20–29	18 (40%)	50 (40%)	
30–39	5 (11%)	55 (28%)	
>40	6 (13%)	55 (28%)	
Sex			NS
Female	15 (67%)	85 (43%)	
Male	30 (33%)	111 (57%)	
Atopy			<i>P</i> < 0.0001
Yes	36 (80%)	44 (22.5%)	
No	9 (20%)	152 (77.5%)	
Type of crop			NS
Flowers	20 (44%)	110 (56%)	
Vegetables	6 (13%)	33 (19%)	
Worsened			
Due to TU	42 (93%)	14 (7%)	<i>P</i> < 0.0001
Mean TU			
Exposure (years)	7.24	6.42	<i>P</i> < 0.05

probability of sensitization to TU was 3.7 times greater in exposed than in non-exposed subjects (*P* < 0.0001).

Discussion

Considering the existence of other sources of antigens in the greenhouse [7], sensitization to TU in greenhouse workers was found to be greater than to common allergens. There are several reasons that could explain this fact: the greenhouse helps the development of this mite due to temperature and humidity conditions. Furthermore, in recent years TU has proliferated extraordinarily in our environment due, perhaps, to its resistance to common pesticides and to

the disappearance of other parasites which were predators to TU.

In the workers studied, a high prevalence of sensitization to TU (25%) and of occupational allergy (19%) has been found. Three parameters significantly increased the risk to TU sensitization: first, atopy; secondly, the length of time working at the greenhouse and the time of exposure to TU; we have demonstrated that a long exposure to TU predisposed to the appearance of TU allergy. The final parameter was a positive clinical history to TU-related symptoms.

Atopy, such as that occurring with other high molecular-weight antigens [8,9], is perceived as a factor with a clear predisposition to TU hypersensitivity. This should be considered as relevant in order to give any possible occupational advice. Moreover, a positive clinical history has shown to be highly profitable since, when a subject notices worsening in relation to the presence of TU, it is probable that he will be allergic to this mite and, due to the fact that TU is a macroscopic mite, it is an important item to be highlighted in the clinical history.

Rhino-conjunctivitis has been the most frequent symptom reported. In our previous study [5] it was estimated that there was a greater proportion of patients with asthma due to the selection criterion of the sample (it was accomplished in workers who were studied because of symptoms compatible with allergic disease).

At least 26% (16/61) of the participants with a positive SPT to TU were asymptomatic; the clinical significance of asymptomatic positivity is not known, but this may identify a group at risk of becoming symptomatic in the future. Prospective follow-up will be required to answer this question.

In the atopic control group, a positive SPT was found in 19 subjects but none referred symptoms related to TU-exposition nor direct contact with the mite. Although the sensitization risk is 3.7 times greater among the exposed workers, this finding compels us to consider that perhaps such recognition could be explained by the fact of living in rural areas, or having ornamental plants that could be parasitized by TU, or because of cross-reactivity with other allergens. In this case it must be stressed that only 29 of 45 TUA recognize house dust mites and, among the atopic controls, 68 subjects were allergic to mites and only 11 showed a positive response to TU.

The present data show a lack of correlation between SPT and RAST assay results, which seems to reveal the possibility of false negative values in the RAST technique when using TU extracts, as with other occupational antigens [10].

In conclusion, a high prevalence of TU sensitization and allergy among greenhouse workers has been found. Atopic individuals are at risk of becoming sensitized to TU and those with positive TU tests and a long exposure time to TU are at risk of developing clinical TU allergy.

Table 3. Skin-prick test to TU in greenhouse workers and the control group

	TU prick (–)	TU prick (+)	Total
Greenhouse workers	180	61	241
Control group	208	19	227
Total	388	80	468

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