

Occupational immunologic contact urticaria from pine processionary caterpillar (*Thaumetopoea pityocampa*): experience in 30 cases

JESÚS VEGA¹, JOSE MARÍA VEGA², IGNACIO MONEO³, ALICIA ARMENTIA², MARIA LUISA CABALLERO³ AND ALBERTO MIRANDA¹

¹Servicio de Dermatología y Facultad de Medicina, Hospital Clínico Universitario, ²Sección de Alergia, Hospital Universitario Río Hortega, and ³Centro de Investigación Clínica y Medicina Preventiva, Instituto de Salud Carlos III, Madrid, Spain

Cutaneous lesions caused by the pine processionary caterpillar *Thaumetopoea pityocampa* (TP) are frequent in pinewood areas. In the present study, 30 patients diagnosed with occupational immunologic urticaria from this caterpillar were included. Immediate hypersensitivity was demonstrated by performing prick and IgE-immunoblotting tests. Workers were grouped according to their common tasks. Occupations at risk of exposure to TP were pine-cone collectors/woodcutters (14), farmers/stockbreeders (8), other forestry personnel (4), construction workers (2), residential gardeners (1) and entomologists (1). Besides contact urticaria, angioedema (60%), papular lesions of several days of evolution (30%) and anaphylactic reactions (40%) were also detected. The most frequently detected molecular weight bands by immunoblot were 15 (70%), 17 (57%) and 13 kDa (50%). The appearance of isolated bands corresponds with the least serious cases. Only 8 subjects had bands higher than 33 kDa, which was present in the 3 most severe cases of anaphylactic reactions. By presenting these cases, we wish to offer the largest series reported so far of occupational immunologic contact urticaria caused by TP. We include the first cases described in certain occupations, some of them not directly related to forestry work. Pine-cone or resin collectors, woodcutters, farmers and stockbreeders were the most frequently and severely affected workers.

Key words: contact urticaria; forestry; immunologic; occupational; pine processionary caterpillar.
© Blackwell Munksgaard, 2004.

Accepted for publication 15 December 2003

The pine processionary caterpillar [*Thaumetopoea pityocampa* (TP)] is a nocturnal lepidoptera of the Thaumetopoeidae family. Its diet mainly consists of different species of pine needles, among them *Pinus pinea* (1).

In its larval stage as a caterpillar, it has small, poisonous hairs capable of penetrating the epidermis and the mucous membranes and producing lesions, mostly at skin level. There have been various mechanisms proposed in the pathogenesis of these lesions: mechanical, chemical and more recently allergic factors (2–9).

TP is an expansive species distributed among Mediterranean and central European countries and is currently the most important defoliator of pine forests in most parts of these geographical areas (1), with consequent economic and occupa-

tional repercussions on the workers who frequent these pine forests.

Such occupational reactions to the caterpillars have been described from various species (3–6, 10–15). We present an analysis of a series of 30 patients who suffered from occupational immunoglobulin E (IgE)-mediated contact urticaria from TP.

Materials and Methods

Patients

In the present study, 30 patients diagnosed with occupational immunologic contact urticaria from TP between 1998 and 2001 were included. They came from Valladolid (northwest Spain) where there are large areas of pine forest.

The diagnosis is based on the existence of a suggestive lesion (a wheal-and-flare response elicited within 60 min after exposure that disappears within 24 h), a history of previous exposure in pine forests and the demonstration of an IgE-mediated mechanism. Only cases with positive prick and immunoblotting tests were considered allergic to the caterpillar. Such pathology should also be caused, conditioned, maintained or aggravated by existing TP in their work environment. Workers were grouped according to their common tasks.

Prick testing

Those patients with a pathology related to exposure to the caterpillar were prick tested with a series of the most frequent pneumoallergens (pollens, mites, epithelia and molds) and with TP. An extract of whole caterpillars in the final larval stage (L5) was prepared at a 1:10 w/v dilution in accordance with the previous studies (3–9). The extract was tested on 10 non-exposed persons with a negative result in all of them.

Histamine dihydrochloride (10 mg/ml) was used as positive control and physiologic saline solution as negative. A reaction of at least 3 mm of wheal diameter above the negative control arising 15 min after prick was regarded as a positive prick test.

Serologic assays (immunoblotting)

In vitro test (IgE-immunoblotting) was performed in patients with a positive prick test to TP. An SDS-PAGE of the extract was performed in 16% acrylamide minigels (SDS-PAGE is a general method for protein analyses and transfer after molecular weight separation). Specific IgE detection by immunoblotting was performed using a diffusion method, as described (16).

Results

Patients

The sample collected corresponded to 30 patients, all of them male, ranging from 19 to 73 years old, with a mean age of 37. 27 subjects usually resided

in rural areas. Occupations at risk of exposure to TP are summarized in Table 1.

12 of the subjects had a history of previous allergies to common pneumoallergens. In addition to contact urticaria, there were other clinical presentations in some patients, including the following: angioedema in different locations (facial, palpebral or genital) (18/30, 60%), papular lesions of several days of evolution (3/30, 10%), conjunctivitis (10/30, 33%) and rhinitis (6/30, 20%). In this study, 12 of 30 (40%) workers had anaphylactic reactions with cutaneous involvement and at least of 1 other system such as rhinitis (6/12, 50%), conjunctivitis (10/12, 83%), dyspnoea (3/12, 25%) or hypotension (1/12, 8%).

Prick testing/immunoblotting

The most frequently detected bands of molecular weight in the immunoblot were 15 (21/30, 70%), 17 (17/30, 57%) and 12 kDa (15/30, 50%). Other bands involved were 33 (7/30) and 25 kDa (2/30). Moreover, 40% of sera detected other bands lower than 12 kDa and 26.6% higher than 33 kDa (these bands appeared in the 3 most serious cases of anaphylactic reactions).

The appearance of isolated bands in 7 patients corresponds to mild cases of isolated urticaria or angioedema and to the smallest instances of wheal diameter on prick testing (between 4 mm and 8 mm).

Discussion

Approximately 150 species of Lepidoptera have been described as causing damage to human skin and several species of caterpillars are equipped with poisonous hairs or chitinous spines that are capable of penetrating the human epidermis and mucous membranes (10). One of these is the pine processionary caterpillar (*T. pityocampa*) which, besides being the cause of considerable damage to forests, is also responsible for certain skin lesions, conjunctivitis and, in rare cases, respiratory symptoms and anaphylactic reactions (3–9, 17–21).

TP is common in Mediterranean and central European countries (1). According to experts, this is not only because of an expanding species

Table 1. Clinical differences between occupations with cases of occupational immunoglobulin E-mediated contact urticaria from pine processionary caterpillar (*Thaumetopoea pityocampa*)

Occupations	Subjects	Angioedema	Contact dermatitis	Anaphylaxis
Pine or resin collectors/woodcutters	14	8	1	7
Farmers/stockbreeders	8	6	–	5
Other forestry personnel	4	3	–	–
Construction workers	2	1	–	–
Residential gardeners	1	–	1	–
Entomologists	1	–	1	–

of Lepidoptera, but also probably due to a decrease in certain predatory birds and global warming.

The caterpillar's urticant hairs appear in the 3rd stage of its development (L3) near to September and progressively increase up to the final stage (L5) that can extend from January to May, depending on the climatic conditions of the area (Figs 1 and 2). In this stage, the caterpillar may have up to 1 million of these hairs which can become airborne and be detected on pollen collectors (17, 19).

Cutaneous lesions, especially contact urticaria, constitute the most important sign of reactions to TP (2–6, 8, 18). Characteristically, these are found on the neck and other uncovered cutaneous regions such as the extremities, although they can also involve covered regions (6, 8) (Fig. 3). In such reactions, physical activity behaves as a variable that increases severity (5). From the first descriptions made by Reaumur in 1736 and later by Fabre in 1900, it became accepted in the scientific community that the only factor responsible for the symptomatology caused by the pine processionary caterpillar was a toxic irritant mechanism of urticant hairs (18–20). However, recently published studies have demonstrated through *in vitro* and *in vivo* tests that an IgE-mediated mechanism is involved in most contact urticaria produced by TP in adults (5, 6).

Less commonly, TP causes delayed cutaneous reactions that last several days and appear in the form of small infiltrated papules, papulovesicles or pustules (5, 8, 18, 19). In these cases, it is thought that a toxic irritant mechanism is responsible (17–21), although other caterpillars have caused a delayed-type allergic reaction (22, 23).



Fig. 1. Pine processionary caterpillar (*Thaumetopoea pityocampa*) in the final larval stage (L5). The caterpillar's urticant hairs are located on the dorsum and give the characteristic brownish colouration to TP.

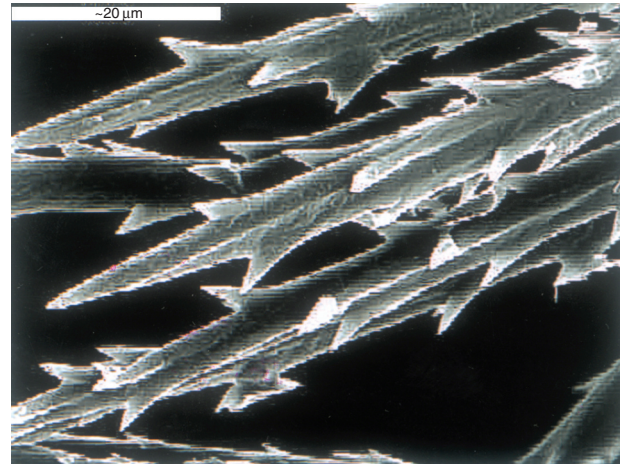


Fig. 2. Electron microscopy of the urticant hairs; they are full of spines directed outwards, able to prick into the skin and the ocular conjunctiva. They may also be able to penetrate the human respiratory tract.

Patients with IgE-mediated contact urticaria are more frequently associated with cases of widespread urticaria and angioedema and can cause anaphylactic reactions; in some cases, serious ones (5, 6). In this study, 40% of workers experienced anaphylactic reactions, of which 3 cases were severe enough to oblige them to change their jobs to avoid exposure to TP.

Workers most frequently affected are pine-cone or resin collectors and/or woodcutters (46%), and farmers and/or stockbreeders (27%) were the only ones who developed anaphylaxis. This could be explained by their heavier exposure to the caterpillar. These workers had direct skin contact with the larvae or the remains of such in dust and aerosols containing particles of dry caterpillar hairs because of brushing against the nests whilst collecting pine cones, cutting wood or coming in contact with the pine forest floor with farm



Fig. 3. Contact urticaria on the neck of a forestry worker.

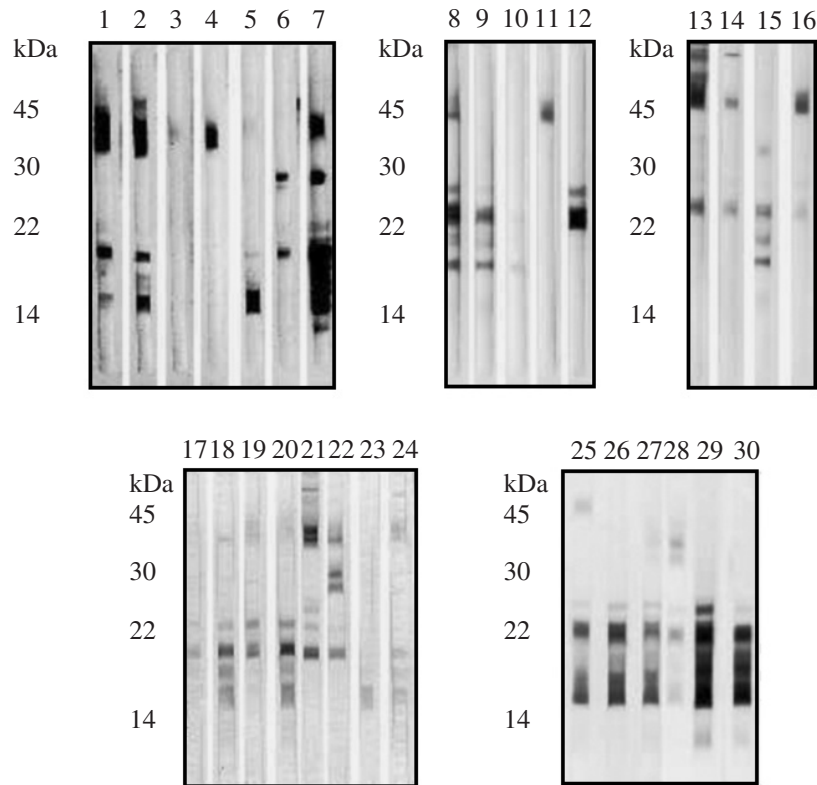


Fig. 4. Immunoblotting using 30 sera from patients allergic to *Thaumetopoea pityocampa*.

machinery or with livestock. In the case of stock-breeders, this complicates the supposed diagnosis, because the disease would sometimes appear following contact with sheep's wool after herding them, even without the workers themselves having gone directly into the pine forest.

Based on our studies, the symptomatology is predominant in the months that the caterpillar is urticant (October to April) although some patients had reactions throughout the whole year (3–8). This fact can be explained by the caterpillar having allergenic proteins in all its stages, as we have previously demonstrated (7).

As in other previous studies (2–9), the detected bands through the IgE-immunoblotting technique oscillated between 45 and 4 kDa (Fig. 4), the lowest bands being the most involved and the dominant being the 15 kDa, which appeared in 70% of the patients. This major caterpillar allergen has recently been isolated and characterized: it corresponds with Tha p1 and shows no homologies to other insect allergens already described (9).

Conclusions

TP is a new occupational allergen that can affect various workers. By presenting these cases, we

wish to offer the largest series reported so far of occupational immunologic contact urticaria caused by pine processionary caterpillar. We include the first cases described in certain occupations, some of them not directly related to forestry work. Immediate hypersensitivity was demonstrated by performing prick testing and IgE-immunoblotting testing.

Cutaneous lesions, especially contact urticaria, constitute the main sign of reactions due to TP, although serious anaphylactic reactions are also frequent. According to this study, pine-cone or resin collectors, woodcutters, farmers and stock-breeders were the most frequently and seriously affected workers, possibly due to heavy exposure to the caterpillar.

Other studies will be necessary to evaluate the true incidence of these occupational dermatoses, including those caused by other pathogenic mechanisms such as delayed hypersensitivity or irritant reactions.

Acknowledgements

The study was supported by a grant of The Foundation of the Spanish Society of Allergy and Clinical Immunology.

References

1. Montoya R. *Thaumetopoea pityocampa* Schiff. In: *Plagas de Insectos en las Masas Forestales Españolas*, Romanyk N, Cadahía D (eds): MAPA, Madrid, 1992: 59–73.
2. Werno J, Lamy M, Vincendeau P. Caterpillars hairs as allergens. *Lancet* 1993; 342: 936–937.
3. Vega J M, Moneo I, Armentia A et al. Anaphylaxis to a pine caterpillar. *Allergy* 1997; 52: 1244–1245.
4. Vega J M, Moneo I, Armentia A et al. Reacciones ocupacionales de hipersensibilidad inmediata a procesionaria del pino (*Thaumetopoea pityocampa*). *Rev Esp Alergol Immunol Clín* 1999; 14: 19–22.
5. Vega J M, Moneo I, Armentia A et al. Allergy to the pine processionary caterpillar (*Thaumetopoea pityocampa*). *Clin Exp Allergy* 1999; 29: 1418–1423.
6. Vega J M, Moneo I, Armentia A et al. Pine processionary caterpillar as a new cause of immunologic contact urticaria. *Contact Dermatitis* 2000; 43: 129–132.
7. Rebollo S, Moneo I, Vega J M et al. Pine processionary caterpillar allergenicity increases during larval development. *Int Arch Allergy Immunol* 2002; 128: 310–314.
8. Vega J, Vega J M, Vega M L et al. Cutaneous reactions to pine processionary caterpillar (*Thaumetopoea pityocampa*) in children. *Allergy* 2003; 58: 87–88.
9. Moneo I, Vega J M, Caballero M L et al. Isolation and characterisation of Tha p 1, a major allergen from the pine processionary caterpillar *Thaumetopoea pityocampa*. *Allergy* 2003; 58: 34–37.
10. Burns D A. Diseases caused by arthropods and other noxious animals. In: *Textbook of Dermatology*, Vol. 3, Champion R H, Burton J L, Ebling F J G (eds): Blackwell Scientific Publications, London, 1992: 1292.
11. Katzenellenbogen I. Caterpillar dermatitis as an occupational disease. *Dermatologica* 1955; 111: 99–106.
12. Blair C. The browntail moth, its caterpillar and their rash. *Clin Exp Dermatol* 1979; 4: 215–222.
13. Etkind P H, O'Dell T M, Canada A T et al. The gypsy moth caterpillar: a significant new occupational and health problem. *J Occup Med* 1982; 24: 659–662.
14. Hesler L S, Logan T M, Benenson M W, Moser C. Acute dermatitis from oak processionary caterpillar in a U.S. community in German. *Mil Med* 1999; 8: 164.
15. Press E, Googins J A, Poareo H et al. Health Hazards to timber and forestry workers from the Douglas fir tussock moth. *Arch Environ Health* 1977; 32: 206–210.
16. Moneo I, Alday E, Sanchez-Agudo L et al. Skin prick test for hypersensitivity to alpha-amylase preparations. *Occup Med* 1995; 45: 151–155.
17. Ducombs G, Lamy M, Bergaud J J et al. La chenille processionnaire (*Thaumetopoea pityocampa* Schiff. Lépidoptères) et l'home. *Ann Dermatol Venereol* 1979; 106: 769–778.
18. Ducombs G, Lamy M, Mollard S et al. Contact dermatitis from processionary caterpillar (*Thaumetopoea pityocampa* Schiff Lepidoptera). *Contact Dermatitis* 1981; 7: 287.
19. Garty B Z, Danon Y L. *Processionary Caterpillar Dermatitis Pediatric Dermatol* 1985; 2: 194–196.
20. Werno J, Lamy M. Pollution atmosphérique d'origine animale: les poils urticants de la chenille processionnaire du (pin). (*Thaumetopoea pityocampa* Schiff, Insectes, Lépidoptères). *Paris: C R Acad Sci* 1990; 310: 325–331.
21. Lamy M, Pastureaud M H, Novak F et al. Thaumetopoein: an urticating protein from the hairs and integument of the pine processionary caterpillar (*Thaumetopoea pityocampa* Schiff, lepidoptera, Thaumetopoeidae). *Toxicon* 1986; 24: 347–356.
22. Natsuaki M. Immediate and delayed-type reactions in caterpillar dermatitis. *J Dermatol* 2002; 29: 471–476.
23. Edwards E K Jr, Edwards E K, Kowalczyk A P. Contact urticaria and allergic contact dermatitis to the saddleback caterpillar with histologic correlation. *Int J Dermatol* 1986; 25: 467.

Address:

Jesús Vega, MD
 C/Ferrari 5, 1ª E
 47001 Valladolid
 Spain
 Tel: +34 647 804066
 e-mail: jveagu@medynet.com