

# Cutaneous reactions to pine processionary caterpillar (*Thaumetopoea pityocampa*) in pediatric population

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Pediatr Allergy Immunol 2003; 14: 482–486. © 2003 Blackwell Munksgaard

Cutaneous lesions caused by pine processionary caterpillar (*Thaumetopoea pityocampa*, TP) are frequent in pinewood areas. However, no epidemiological studies have been performed so far in the pediatric population. In this study, we evaluated the relevance of reactions to pine processionary caterpillar in the pediatric population of our environment and determined the possible role of an IgE-mediated mechanism.

A questionnaire was developed and given to 1101 children and adolescents ranging from 3 to 17 years of age from rural areas with large pine forests. A total of 653 questionnaires were answered by the children or their parents. The search for immunoglobulin E (IgE)-mediated cases was based on the presence of a suspected reaction to caterpillar and confirmed by *in vivo* (skin prick) and *in vitro* (immunoblotting) tests.

Sixty of the 653 people interviewed (9.18%) identified a cutaneous reaction from exposure to the processionary caterpillar. Within this group only four cases (6.7%) were because of an IgE-mediated mechanism. The predominant clinical feature of these patients with allergy to caterpillar was contact urticaria.

We present the first study of cutaneous reactions to pine processionary caterpillar in a large pediatric population. This is a frequent pathology in pinery zones and only in a minority of the cases are because of an IgE-mediated allergic mechanism. This fact contrasts with studies in adults, where this percentage is much greater.

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Key words: pine processionary caterpillar; *Thaumetopoea pityocampa*; pediatric; allergy; Immunoglobulin E

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Accepted 10 February 2003

The capacity of pine processionary caterpillar (*Thaumetopoea pityocampa*, TP, Fig. 1) to trigger pathological dermatologic reactions is well known from ancient times. The first descriptions were made by Reaumur in 1736 (1) and since then different studies have provided new insights about the pathogenesis of these reactions involving mechanical, chemical and, more recently, allergic factors (2–8).

In recent years it has been possible to demonstrate the presence of an allergic hypersensitivity mechanism mediated by immunoglobulin E (IgE) in a high percentage of

reactions to this caterpillar (6, 8). We have found only three reports that specifically refer to lesions caused by processionary caterpillar in children (1, 2, 9) but none presented a broad epidemiologic study nor evaluated adequately the importance of IgE-mediated reactions in the pediatric population. For this reason, we have performed the present study in order to evaluate the percentage of children and adolescents presenting cutaneous symptoms related to exposure to this caterpillar in our environment and consider the role an IgE-mediated mechanism in these reactions.

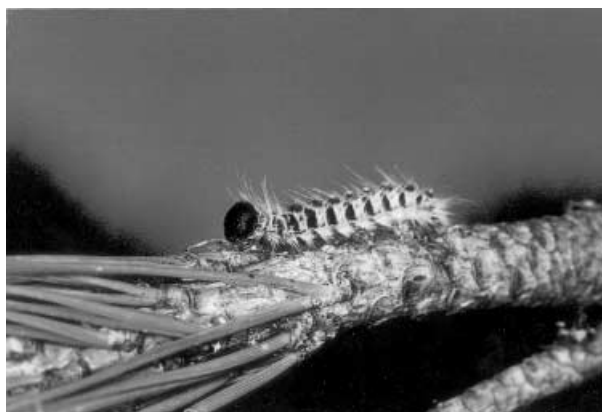


Fig. 1. Pine processionary caterpillar (*Thaumetopoea pityocampa*) in the last larval stage (L5). It presents white hairs of greater size (2–3 mm in length) and others, much more numerous and small (0.2–1 mm in length), that are located at the dorsum and which give the characteristic brownish coloration to the pine processionary caterpillar. These small hairs have a urticant capacity and are detectable in the air by means of techniques designed for airborne microorganisms and pollen research.

## Material and methods

### Patients

A descriptive survey was performed on a pediatric school population in a rural area in the province of Valladolid (northwest of Spain) where there are large zones of pine trees. A questionnaire was given to 1101 children and adolescents ranging from 3 to 17 years of age within an estimated population in the area of 1303 children of similar age. A total of 653 answered the questionnaire (either by themselves or their parents). The questionnaire included: age, sex, personal and family history of allergic diseases, presence or absence of skin lesions after touching caterpillars and/or after going to pine forests as well as the characteristics of the lesions (latency period, duration and localization) and the period of occurrence of symptomatology.

The criteria for regarding a reaction as contact urticaria (CU) from TP were: a clear history of previous exposure to caterpillar hairs showing whealing of skin, elicited within 60 min of walking or playing in a pinewood; cutaneous lesions should disappear within 24 h; in accordance with the biological cycle of this insect, patients should have such symptoms only during the months in which the caterpillar is urticating (September–April); no symptoms outside pinewood areas should be detected (8). By exclusion, we have used the term contact dermatitis (CD) in other contact cutaneous lesions. Although histologically both lesions can be distinguished, this study has been performed in children and we

preferred to avoid the cutaneous biopsy. Only the children with positive skin prick test (SPT) and IgE-immunoblotting to TP were considered as TP allergic.

### Skin prick test

Those children who answered the questionnaire in a positive manner were given an SPT with a series of the most frequent aero-allergens (pollens, mites, animal epithelia, and molds) and with TP. An extract of whole caterpillars in the last larval stage (L5) was prepared at a dilution of 1:10 (w/v), in accordance with previous studies (5–8). The extract was tested in 10 non-exposed children (five atopic and five non-atopic).

Histamine dihydrochloride (10 mg/ml) was used as a positive control and physiologic saline solution as a negative one. Reactions were read after 15 min and a response was recorded as positive if the average diameter of the wheal reached at least 3 mm.

### Serologic assays (immunoblotting)

*In vitro* test (IgE-immunoblotting) was performed in children with positive SPT to TP. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis of the extract was performed in 16% acrylamide minigels. Specific IgE detection by immunoblotting was performed using a diffusion method, as previously described (10). The serum from one atopic child was used as control.

## Results

Of the 653 children and adolescents studied, 297 were male and 356 female, ranging from 3 to 17 years of age, with a mean of 10 years.

Sixty children of those questioned (9.2%) referred to a cutaneous symptomatology related to TP. From these, 33 (55%) presented papulous or whealing lesions of less than 24 h of duration and in 18 cases (30%) the lesions lasted more than 24 h. In nine cases (15%) they were not able to specify these data.

The period of occurrence of symptomatology was mainly winter–spring (56%) and spring–summer (24%), followed by summer alone (10%), autumn (8%), and winter (2%). The most frequent sites of lesions were the extremities (71.66%), followed by the trunk (35%), neck (13.33%), and head (11.66%).

Positive SPT to common aero-allergens was found in 32/60 cases (53.3%).

Skin prick test with extract of caterpillar was positive in 13/60 children (21.7%) with cutaneous

symptomatology associated to TP and negative in all the control subjects. Positive SPT was found in 11/33 children (33.3%) who had CU and 2/18 (11.1%) with CD. We did not observe delayed local reactions to TP SPT. Only 4/12 children (33.3%) with positive SPT had a positive immunoblotting (Fig. 2). The percentage of

IgE-mediated allergic reactions was 6.8% (4/59). The extraction of serum was not possible in one patient with positive prick to the caterpillar. In Table 1 we summarize the characteristics of the four cases in which an IgE-mediated mechanism was evident.

### 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 of chitinous spines that are capable of penetrating human epidermis (11). One of them is the pine processionary caterpillar (TP), that besides being the cause of considerable damage to forest is also responsible for certain skin lesions (CD and more commonly, CU), conjunctivitis and rarely, respiratory signs and anaphylactic reactions have been described in animals and people (1–8).

*Thaumetopoea pityocampa* is frequent in the Mediterranean area and southern Europe. This insect is the most important defoliator of Spanish pine trees. It attacks all our species of pine (*Pinus pinaster*, *P. silvestris*, *P. halapensis*, *P. nigra*, *P. pinea*, *P. radiata*, *P. ponderosa* and *P. canariensis*) and cedar trees (12). Its urticant hairs (Fig. 3) appear in the third stage of its development (L3) around September, and progressively increase up to the last stage (L5) that can extend from January to May, depending on the climatic conditions of the zone. They are detectable in the air by means of techniques designed for airborne microorganisms and pollen research (13).

From the first descriptions by Reaumur in 1736 and later by Fabre in 1900 (1), it has been accepted in the scientific community that the only factor responsible for the symptomatology caused by the pine processionary caterpillar was a toxic-irritating mechanism of the urticant hairs which, after pricking and breaking in the skin,

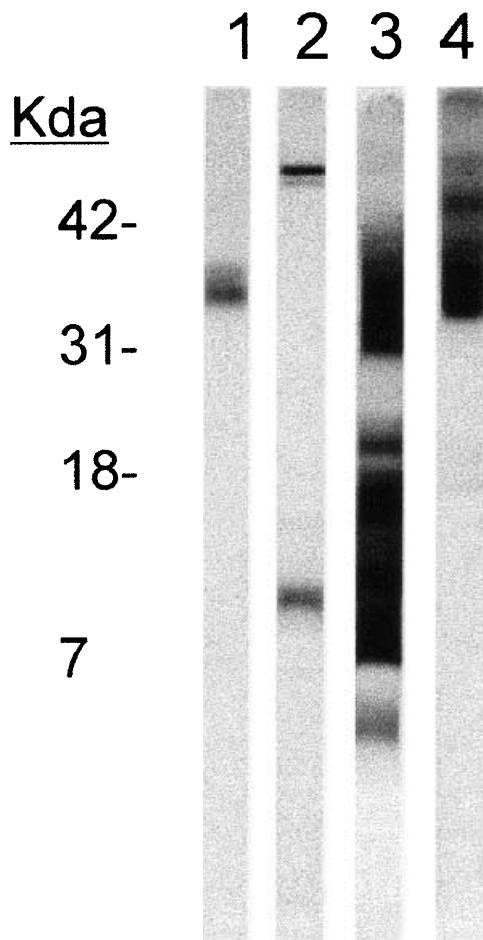


Fig. 2. Immunoglobulin E immunoblotting using whole processionary caterpillar extract detected several reactive bands with apparent molecular weights between 45 and 4 kDa. Lanes 1–4: cases 1–4 (Table 1).

Table 1. Characteristics of four children with reaction to pine processionary caterpillar in which an Immunoglobulin E-mediated mechanism was evident (positive skin prick and immunoblotting test)

|                                     | Case 1        | Case 2            | Case 3                 | Case 4        |
|-------------------------------------|---------------|-------------------|------------------------|---------------|
| Age                                 | 11            | 10                | 9                      | 17            |
| Sex                                 | Male          | Male              | Male                   | Male          |
| Allergy to common allergens         | Yes           | Yes               | Yes                    | No            |
| Cutaneous lesions                   | CU            | CU                | CU                     | CD            |
| Localization                        | Extremities   | Extremities trunk | Extremities trunk neck | Extremities   |
| Skin prick to TP (mm <sup>2</sup> ) | 16            | 9                 | 40                     | 40            |
| Season                              | Winter–spring | Spring–summer     | Spring–summer          | Winter–spring |

TP, *Thaumetopoea pityocampa*; CD, contact dermatitis; CU, contact urticaria.

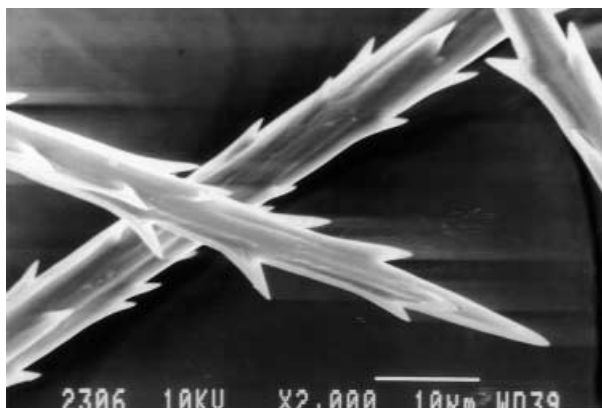


Fig. 3. The electron microscope shows that the smallest hairs resemble harpoons full of spines directed outwards, able to prick the skin and ocular conjunctiva. They may also be able to penetrate the human respiratory system up to the trachea and primary bronchi.

inoculated histamine-liberating substances able to initiate the degranulation of basophils (1–3). However, recent studies made by our research group have demonstrated the existence of an allergic mechanism of hypersensitivity mediated by IgE in a high percentage of reactions to this caterpillar, although most of studied patients were adult (5–8).

In areas where pine trees abound, outpatient pediatric consultations for symptoms related to this caterpillar are frequent. Nevertheless, the studies carried out in children are very few (1, 2, 9), and there are no epidemiological studies. There has been no due evaluation of the role of IgE-mediated reactions in the pediatric population.

The present study shows that reactions to TP are frequent in pine tree zones, affecting 9.2% of children and adolescents. Clinical manifestations vary and may include pain, pruritus and maculopapular, vesicular or urticarial lesions. In our survey, the most frequent symptomatology was CU (64.7%), characterized by papular or whealing lesions of less than 24 h of duration. It is followed by CD (35.3%), where the lesions might also present the shape of urticaria but lasted longer than 1 day. In all the cases, pruritus was frequent and sometimes intense.

In our experience, based on previous works (5–8), the most important differences between the reactions to TP in children and adults can be summarized in Table 2.

The less severe symptoms in children could be explained by the low participation of IgE-mediated reactions and because in adults most of the described cases of anaphylaxis were present in

Table 2. Differences between the reactions to pine processionary caterpillar (*Thaumetopoea pityocampa*) in children and adults

|                                            | Children    | Adults                  |
|--------------------------------------------|-------------|-------------------------|
| Anaphylactic reactions                     | None        | Several described cases |
| Localization                               | Extremities | Neck                    |
| Immunoglobulin E-mediated reactions        | Rare        | Frequent                |
| Correlation skin prick/immunoblotting test | Low         | High                    |

workers under high exposure to the caterpillar. In children the involvement of extremities is more frequent, probably because of the kind of games they usually play.

The percentage of IgE-mediated cases is significantly smaller in children (6.8%) than in adults (more than 50%) (6,8), which is comparable with the natural development of hypersensitivity to the poison of other insects. In order to confirm the diagnosis of IgE-mediated allergy to pine processionary caterpillar in children it would be necessary to perform an *in vitro* test, given the low correlation between prick and immunoblotting tests, although the skin prick test can be useful as a screening test. Previous studies have been carried out on patients who consulted their doctor after suspecting allergic pathology. This fact might explain the minor correlation between positive SPT and immunoblotting test in this work, in which we studied children for rural areas. Also, it is possible that children have a higher cutaneous reactivity to toxic-irritating substance(s) from this caterpillar.

The main objective in these patients is to avoid re-exposure. Treatment is determined by the symptomatology. Application of topical corticosteroids of relatively high potency may alleviate pruritus in TP-CD. As in other allergic diseases, the treatment of allergic TP-CU includes measures to relieve the prominent symptoms of pruritus with high doses of antihistamines and, at times, corticosteroids. In anaphylactic reactions, rapid recognition and immediate treatment is essential (8).

To conclude, reactions to TP should be considered in the differential diagnosis of urticaria and dermatitis in children in endemic zones. Only in a few cases are these reactions because of an allergic IgE-mediated mechanism, a fact that contrasts with the studies performed in adults where this percentage is much greater.

#### Acknowledgment

The study was supported by a grant from the *Fundación de la Sociedad Española de Alergología e Inmunología Clínica*.

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