Case Report

# Mantis Shrimp Allergy

R Eiró Alonso,[1] B Bartolomé Zavala,[2] JM Soler Escoda[1]

[1]ALLERCEN (Allergy Center) Barcelona-Spain
[2]Lab. Bial-Aristegui R&D Department. Bilbao, Spain

**Abstract.** We report the case of a 25-year-old female who experienced two immediate episodes of labial, lingual and larynx angiodema after eating fried mantis shrimp (Squilla empusa), a crustacean belonging to the Squillidae family, and a third episode after eating shellfish pudding. Prick by prick tests to mantis shrimp and to other crustacean were positive. Serum specific IgE showed higher values than 0.35 kU/L to extracts from mantis shrimp shell, prawn, large prawn and crab. Serum specific IgE against large prawn tropomyosin were below 0.35 kU/L. Sodium dodecyl sulfate polyacrylamide gel electropheresis (SDS-PAGE) immunoblotting results with raw mantis shrimp shell revealed IgE-binding bands of 46 kDa and 25 kDa, in non reducing and reducing conditions, respectively. Cross-reactivity studies using the enzyme allergo sorbent test (EAST)-inhibition and Immunoblotting-inhibition methods showed the existence of significant cross-reactivity between the IgE-binding proteins present in mantis shrimp and those from prawn, large prawn and small crab.

**Key words:** Mantis shrimp. Squilla empusa. *Crustaceans*. Immediate hypersensitive reaction. Cross-reactivity. Tropomyosin.

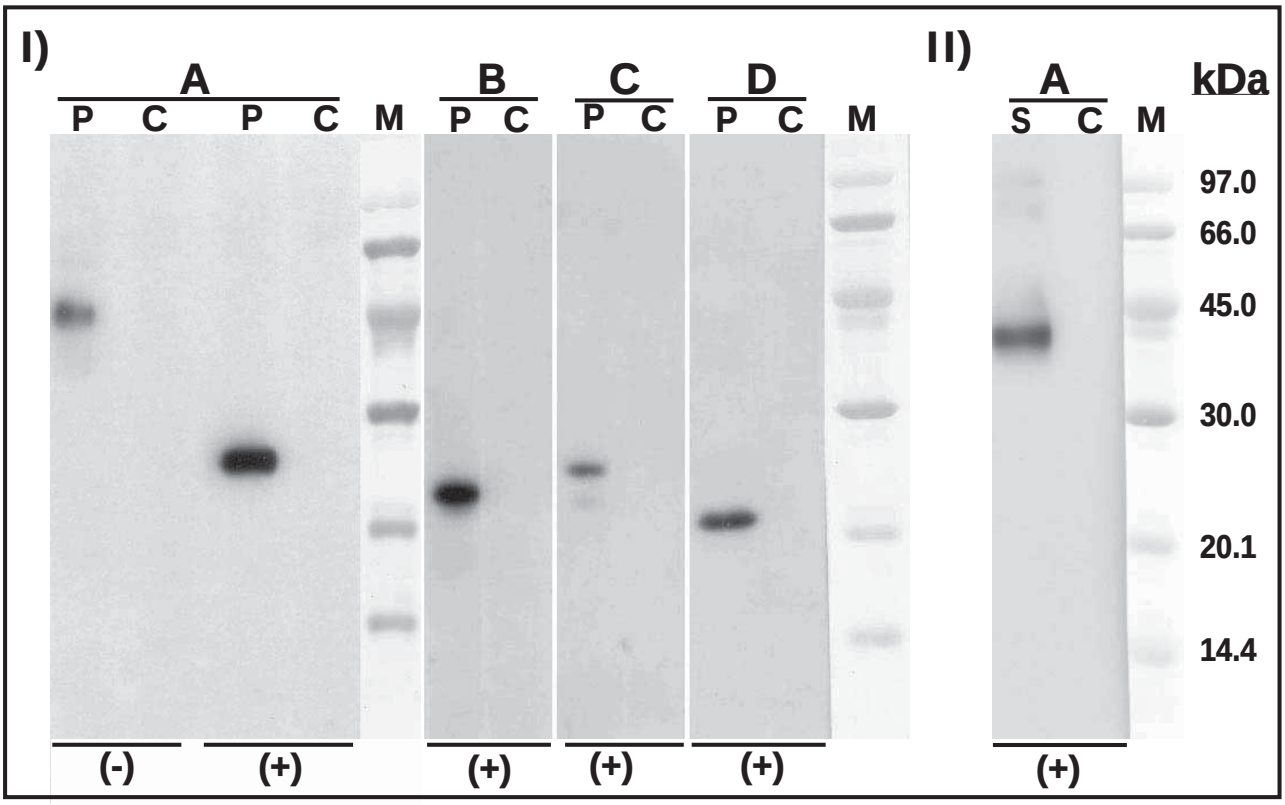
**Resumen.** Presentamos el caso de una mujer de 25 años que sufrió dos reacciones de alergia inmediata con angioedema labial, lingual y de laringe tras ingerir galera (Squilla empusa) frita, crustáceo de la familia Squillidae, y una tercera reacción por ingestión de pastel de marisco. La prueba de prick- prick con galera y con otros crustáceos resultó positiva. Los niveles de IgE específica sérica frente a los extractos de galera, gamba, langostino y cangrejo fueron mayores de 0.35 kU/L, siendo menores de este valor para la tropomiosina de langostino. El SDS-PAGE Immunoblotting con el extracto de galera, reveló una banda de 46 kDa en condiciones no reductoras, y una de 25 kDa en condiciones reductoras. Los resultados de EAST-inhibición e Immunoblotting-inhibición mostraron la existencia de una significativa reactividad cruzada entre las proteínas fijadoras de IgE específica presentes en los extractos de galera, gamba, langostino y cangrejo.

**Palabras clave:** Galera. Squilla empusa. Crustáceos. Hipersensibilidad inmediata. Reactividad cruzada. Tropomiosina.

## Case Report

The patient was a 25-year-old female who suffers from rhinitis due to olive and weed pollen allergy as well as cat dander allergy. She also had hypothyroidism treated with Levotiroxine. She presented after twice suffering from edema of the lower lip, tongue, and larynx immediately after eating fried mantis shrimp (Squilla empusa), two and four months previously. At a later date, she suffered from the same symptoms after eating a crustacean pudding. She tolerates white and blue fish and cephalopods. The mantis shrimp (Squilla empusa) is a crustacean belonging to the Squillidae family.

Aeroallergen skin test results were positive to extracts from olive and weed pollens, and cat dander. Skin tests with a commercial food battery (including shellfish) were negative. Skin prick tests (SPT) were performed with a panel of aeroallergens and food (including shellfish) commercial extracts together with the Prick by Prick method with natural food (lobster, shrimp, prawn, Norway lobster, sea crab, crab and mantis shrimp). A mean wheal area of 7 $mm^2$ or greater compared with the negative control (saline serum 0.9%), 15 minutes after puncture, was considered a positive response. These tests were positive for prawn (6x6mm), large prawn (6x7mm), lobster (5 × 5mm), Norway lobster (9 × 7mm), sea crab (4 × 5mm), crab (4 × 4mm) and mantis shrimp (8 × 8mm).




A) Raw mantis shrimp shell extract; B) Raw prawn extract; C) Raw large prawn extract; D) Cooked crab extract. Lane P: Patient's serum; Lane C: Control serum (pooled sera from non atopic subjects) II) IgG-Immunoblotting results; Lane S: Rabbit anti-prawn tropomyosin; Lane C: Control serum (serum from non immunized rabbit). M: Molecular mass marker. (-) sample without 2-mercaptoethanol, (+) sample with 2-mercaptoethanol.

*Figure.* I) SDS-PAGE IgE-Immunoblotting results

*Table.* EAST-inhibition results. Mantis shrimp as solid phase and extracts from other crustaceans as inhibitor. (All inhibitor extracts were used at 1 mg/ml)

| Solid Phase (Protein extract) | | % Inhibition Inhibitor Phase* (Protein extract) | | | | | |
|---|---|---|---|---|---|---|---|
| Mantis shrimp | Mantis shrimp | Prawn | Dublin Bay prawn | Large prawn | Lobster | Crab | Pollen from sunflower |
| | 60 | 25 | 6 | 35 | 24 | 33 | 0 |

Serum specific IgE levels were determined by the EAST method (Lab Bial-Aristegui). Results were positive to protein extracts from raw mantis shrimp shell (2 kU/L), raw prawn (3.6 kU/L), raw large prawn (1 KU/L), raw Norway lobster (0.6 KU/L), boiled crab (1.8 kU/L), raw lobster (0.5 kU/L) and negative to raw mantis shrimp meat, raw sea crab, raw octopus, raw squid, and large prawn tropomyosin.

The molecular mass of the IgE binding proteins from various crustacean extracts were studied by SDS-PAGE immunoblotting. Results from raw mantis shrimp shell revealed an IgE-binding band of 46 kDa in non reducing conditions (without 2-mercaptoethanol), and a band of 25 kDa in reducing conditions (with 2-mercaptoethanol). IgE binding bands of similar molecular mass were revealed in reducing conditions in extracts from other crustaceans: prawn (23 kDa), large prawn (25/23 kDa) and crab (21 kDa) (Figure). In 1981, Hoffman et al [1] described a 21-kDa minor shrimp allergen which existed primarily as a 45-kDa dimer, the characteristics of which coincide with those of the allergen described in this case.

Cross-reactivity studies between mantis shrimp shell extract and extracts from other crustaceans (prawn, Norway lobster, large prawn, lobster and crab) were

performed using the EAST-Inhibition and SDS-PAGE immunoblotting-inhibition assay. Results using the EAST inhibition technique proved the existence of a significant cross-reactivity between IgE-binding proteins present in the extracts of raw mantis shrimp shell and those proteins present in the extracts from raw prawn, raw large prawn, raw lobster and cooked crab (Table), similar results were obtained in Immunoblotting assays (results not shown).

## Discussion

The majority of published studies involve tropomyosin, a 36–38 kDa protein, in the cross-reactivity among different species of crustaceans and between crustaceans and other orders of arthropods [2, 3, 4, 5]. In recent years, an arginine kinase, a protein of 40 kDa, Pen m 2, has been described as another cross reactivity allergen among different species of crustaceans [6]. However, in the present case, the cross-reactivity detected could not be attributed to any of these allergens since we did not find significant IgE levels for large prawn tropomyosin in the patient`s serum, and the mantis shrimp specific IgE-binding band which disapperared in the IgE-blotting-inhibition assay was a 25 kDa protein: a different molecular mass from those described to tropomyosin and arginine kinase (the mantis shrimp tropomyosin has a molecular mass of 38 kDa as could be deduced from the mantis shrimp blotting incubated with anti-tropomyosin rabbit serum).

In conclusion we describe an immediate hypersensitive reaction, type 1, after eating Mantis shrimp. An IgE-binding protein of 25 kDa (reducing conditions) was detected. This protein crossreacts with others present in prawn, large prawn, lobster and crab.

To the best of our knowledge this is the first published case of allergy to Mantis shrimp.

## References

1. Hoffman DR, Day ED, Miller JS. The major heat stable allergen of shrimp. Ann Allergy. 1981;47:17-22.
2. Reese G, Ayuso R, Lehrer SB. Tropomyosin: an invertebrate pan-allergen. Int Arch Allergy Immnunol. 1999;119:247-58.
3. Leung PS, Chen YC, Chu KH. Seafood allergy: tropomyosins and beyond. J Microbiol Immunol Infect. 1999;32(3):143-54.
4. Shanti KN, Martin BM, Nagpal S, Metcalfe DD, Rao PV. Identification of tropomyosin as the major shrimp allergen and characterization of its IgE binding epitopes. J.Immunol. 1993;151(10):5354-63.
5. Ayuso R, Reese G, Leong-Kee, Matthew P, Lehrer SB. Molecular basis of arthropod cross-reactivity: IgE-binding cross-reactive epitopes of shrimp, house dust mite and cockroach tropomyosins. Int Arch Allergy Immunol. 2002;129:38-48.
6. Yu CJ, Lin YF, Chian BL, Chow LP. Proteomics and Immunological analysis of a novel shrimp allergen, Pen m 2. J Immunol. 2003;170:445-53.

JM Soler Escoda

ALLERCEN (Allergy Center)
C/ Paris 66, 64; 2º, 1ª esc B
08029 Barcelona, Spain
Fax: +34 933227796
Tel.: +34 933226455
E-mail: contacte@allercen.com