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Clinical report/Molecular allergy in practice

A case report of anaphylaxis to *Physalis alkekengi* fruit: The culprit is in the seeds!

*Un cas clinique d'anaphylaxie au fruit du *Physalis alkekengi* : le coupable est dans les graines !*

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Abstract

The first documented case report of Japanese lantern fruit (*Physalis alkekengi*) anaphylaxis caused by a hidden seed cupin allergen, associated with cross-reactivity with the broad bean (*Vicia faba*) cupin allergen.

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Keywords: *Physalis alkekengi*; Broad bean (*Vicia faba*); Seed; Cupin allergen; Cross-reactivity; Cross allergies

Résumé

Un cas clinique documenté d'anaphylaxie au fruit du *Physalis alkekengi* dû à des cupines, allergènes cachés des graines, associé à une réactivité croisée avec les allergènes cupines des graines de fève (*Vicia faba*).

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Mots clés : *Physalis alkekengi* ; Fève (*Vicia faba*) ; Graine ; Allergènes cupines ; Réactivité croisée ; Allergies croisées

A severe anaphylactic reaction with edema and associated drop in blood pressure was observed in a 9-year-old girl following consumption of a single Japanese lantern cherry fruit (*Physalis alkekengi*, Solanaceae) (Fig. 1A). In addition, she experienced further anaphylactic response following the ingestion of freshly harvested young broad beans (*Vicia faba*, Fabaceae). Skin prick tests were negative for the pulp of *Physalis* fruit but gave a strong response with a 12-mm wheal when fresh broad bean was used as a probe.

In SDS-PAGE and Western blotting tests, three 50–60 kDa protein fractions of broad bean readily interacted with IgE from the patient's serum, and following digestion in gel with trypsin, these were identified by mass spectrometry as convicilin and legumin subunits (Fig. 1B, C). No IgE-binding was observed

with a protein extract prepared from the pulp of *Physalis* fruit (result not shown). However, a protein extract prepared from tiny seeds spreading into the pulp of the *Physalis* fruits was analyzed by SDS-PAGE and Western blot. A strong IgE interaction occurred with 50 and 35 kDa protein fractions from the seed protein extract (Fig. 1D, E), and both fractions were identified by mass spectrometry as cupin protein subunits closely related to tomato vicilin [1]. The cupin nature of the *Physalis* seed allergen was confirmed by the strong reaction in the Western blot with the serum of a peanut-allergic patient containing IgE that reacts specifically with Ara h 1 vicilin allergen (Fig. 1F).

Cupin proteins, especially vicilins, consist of homotrimeric proteins constructed from the non-covalent association of three identical protomers (Fig. 1G). The latter are particularly abundant in legume seeds and contribute to the allergenic propensity of ground nut (Arah 1) and of many tree nuts (Ana o 1, Pis v 1, Cor a 1, Jug r 1) [2]. Their unexpected occurrence

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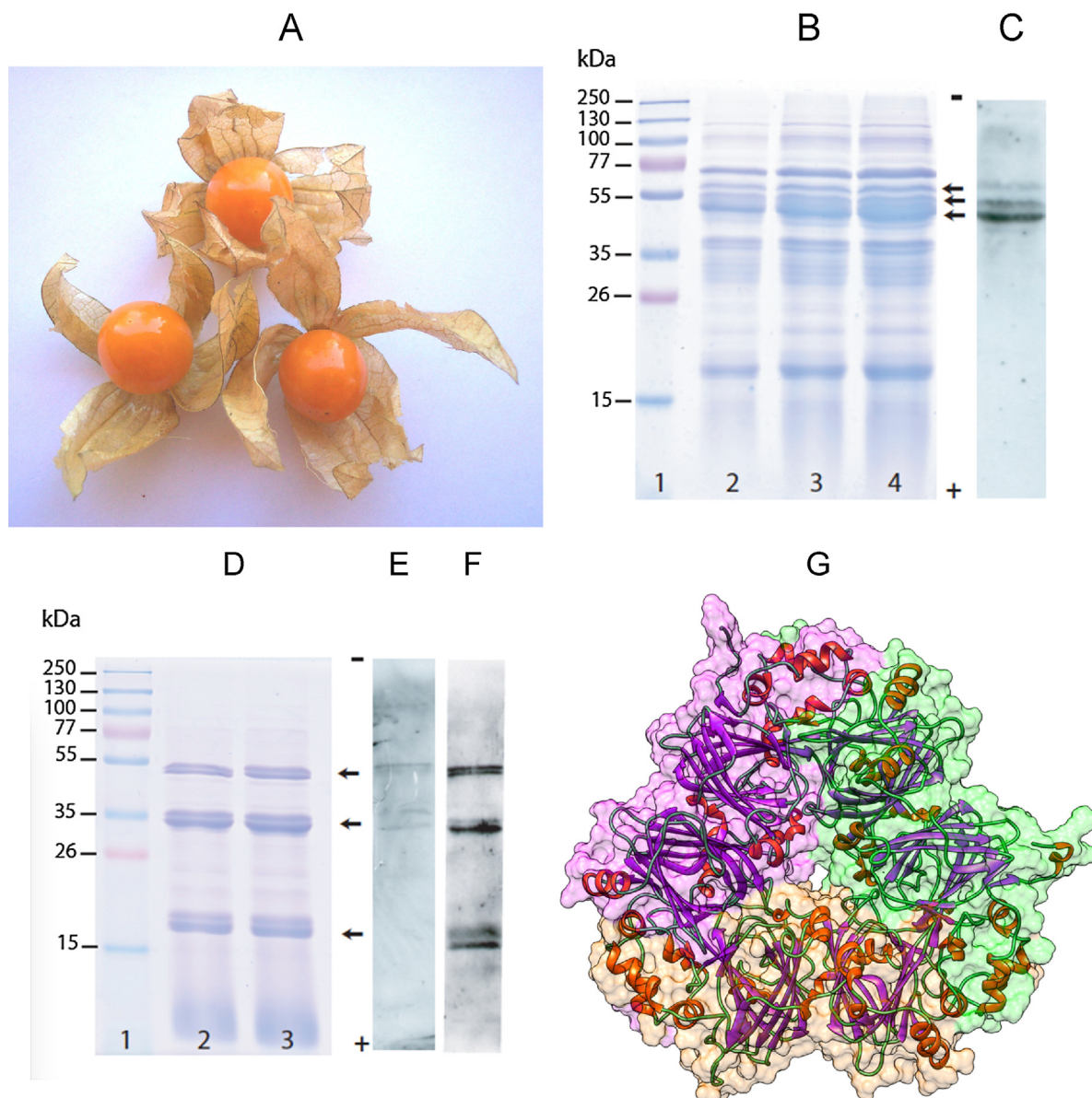


Fig. 1. A. *Physalis alkekengi* fruit. B. Coomassie-staining of increasing concentrations of a protein extract of broad bean seeds separated by SDS-PAGE. The protein bands indicated by arrows were identified as cupin proteins. C. Western blot showing the IgE-reactive fractions of the broad-bean protein extract. D. Coomassie-staining of increasing concentrations of a protein extract of *Physalis* seeds separated by SDS-PAGE. The protein bands indicated by arrows were identified as cupin proteins. E. Western blot showing the IgE-reactive fractions of *Physalis* seed extract. F. Western blot showing the interaction of IgE from a peanut-allergic patient with *Physalis* seed extract. G. Ribbon diagram of tomato vicilin, which consists primarily of three β sheet-containing protomers (different colors) combining to form a flattened triangular homotrimer.

in *Physalis* fruit accounts for the cross-anaphylactic reaction observed between *Physalis* fruit and fresh broad beans. These results point to the role of tomato seed vicilin, which is closely related to the *Physalis* cupin allergen, in certain cross-allergic responses in individuals presenting allergy to tomato fruits.

Obviously, cupin allergens have long been classed as major allergens occurring in a variety of legume seeds such as peanut (*Arachis hypogaea*) [3], lentil (*Lens culinaris*) [4], pea (*Pisum sativum*) [5], chickpea (*Cicer arietinum*) [6], lupin (*Lupinus albus*) [7], kidney bean (*Phaseolus vulgaris*) [8], and broad bean (*Vicia faba*) [9]. However, cupin allergens also occur as

seed storage proteins in many other seeds, and the present case report illustrates their occurrence in fruit seeds as hidden allergens responsible for severe allergic responses in previously sensitized individuals.

To our knowledge, this is the first documented report dealing with the occurrence of cupin allergens as hidden allergens in the seeds of *Physalis alkekengi* fruit. Due to their tiny size, seeds are currently swallowed upon ingestion of the fruit, as a result of which their cupin allergen components become readily available to trigger an anaphylactic reaction in sensitized subjects. In addition, due to the extremely conserved character of both vicilin and legumin allergens, cross-reactivity/allergy can

develop with other cupin allergen-containing seeds and fruits [10–12].

Disclosure of interest

The authors declare that they have no competing interest.

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