

Botanical Briefs: Kiwifruit (*Actinidia chinensis*)

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Kiwifruit allergy has been reported with increasing frequency in the last few decades, paralleling the growth in both its worldwide production and popularity. The reported reactions have widely varied from localized oral allergy syndrome^{1,2} to life-threatening anaphylaxis.³⁻⁵ Patients allergic to kiwifruit also often react to birch pollen⁶⁻⁸ and latex,^{9,10} most likely due to cross-reacting IgE antibodies.

Cutaneous Manifestations

The kiwifruit is a relatively new fruit in the western hemisphere and was first available commercially in the United States in the 1970s. Common cutaneous reactions include contact urticaria after handling fruit and oral allergy syndrome, including swelling of the lips and tongue accompanied by pruritus and a burning sensation in the mouth after ingestion. Oral allergy syndrome also has been reported after being kissed by someone who has eaten kiwifruit.¹¹ Hand and face dermatitis may follow handling of the fruit or the vines.¹²

Distribution

The kiwifruit is native to southern China and it is the national fruit of the People's Republic of China. In the early 20th century, the seeds of the kiwifruit were introduced to New Zealand and eventually were planted for commercial sale by the 1940s. Currently, Italy is the leading producer of the kiwifruit, but China, New Zealand, Chile, France, Japan, and the

United States also are major producers. The plants need a long growing season and at least 240 days without frost; as a result, they generally are grown in areas with temperate climates and an adequately long summer season. Other varieties exist that can be grown in colder climates. They produce small fruit lacking the characteristic brown fur of their larger cousins (Figure 1) and are commonly marketed as kiwi berries, which can be eaten whole without being peeled.

Identifying Features

The plant of the kiwifruit grows as a twining vine or climbing shrub (Figure 2). It can grow about 25 to 30 ft per year to a height of 9 to 12 ft and covering an area 10- to 15-ft wide in one growing season. The foliage of the plant emerges as young leaves and shoots that are covered with red hairs. As the plant matures, the leaves lose these hairs and become a deep green color. The fragrant flowers that emerge along the vine are white to cream colored and grow in clusters. They are dioecious, so both male and female plants must be grown to produce fruit. In the northern hemisphere, the flowering period is from May to June and seeds ripen from October to December. The familiar fruit of the plant is ovoid and grows to be approximately 2.5-in long. The skin of the fruit is brown and is covered with short brown hairs. Its succulent flesh usually is bright green, except for a firm white center from which many thin lines radiate. Dark seeds line the edge of the white center. As the fruit ripens, the flesh becomes less firm and sweeter in taste.

Dermatitis-Inducing Plant Parts

Several components of the kiwifruit and its vines have been reported to cause dermatologic reactions in sensitized individuals. The flesh of the kiwifruit can produce localized oral mucosal symptoms,^{1,2,11} such as swelling, burning, and pruritus, as well as generalized reactions, such as urticaria or generalized erythema.¹³

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Furthermore, both the skin and flesh of the fruit have been observed to cause allergic contact dermatitis when touched.¹⁴ Dermatitis of the hands and face may occur after handling the vines of the plant.¹²

Nomenclature

The kiwifruit is a member of the Actinidiaceae family, which includes 3 genera and approximately 360 species. The genus name *Actinidia* comes from the Greek word *aktinos* (ray), which refers to the styles (parts of the pistils) of the female flower that radiate from the center and resemble the spokes of a wheel, while *chinensis* refers to China, the geographic origin of the kiwifruit.

Allergens

The main allergen present in the kiwifruit is actinidin, a 30-kDa proteolytic enzyme of the class of thiol proteases.¹⁵ Actinidin comprises approximately 50% of the soluble proteins of the fruit. It evokes an IgE response in sensitized patients and binds IgE of more than 90% of patients with kiwifruit allergy. The enzyme is secreted in an inactive form, known as actininidin, and cleavage to its active form is necessary for it to fully express its allergenic activity because it appears to bind IgE only after removal of its pro-sequence.¹⁵ Sensitivity to a 40-kDa protein also has been documented. Actinidin and this 40-kDa protein have both been linked to anaphylaxis.¹⁶ Kiwellin, a 28-kDa protein that accounts for about one-third of the kiwifruit's protein content also has been identified as an important allergen, recognized by IgE in the sera of allergic patients.¹⁷ A fourth allergen, a thaumatinlike protein, has been characterized as a 24-kDa protein, and it appears to play a role in patients who present with oral allergy syndrome,¹⁸ which is a type 1 hypersensitivity reaction that occurs in response to eating fruits, vegetables, or nuts in certain pollen-sensitized individuals. The symptoms manifest as burning, itching, or swelling of the mouth, lips, tongue, and throat that result from contact urticaria of the mucosal surfaces. Other allergens have been identified as possible major or minor allergens but have yet to be fully characterized.⁶

Severity of reactivity varies widely, particularly with age. Life-threatening anaphylactic reactions can result and have been increasingly observed in young children. These children generally are more likely to react on their first known exposure to the kiwifruit than adults, whereas adults tend to require multiple exposures before developing clinical symptoms.¹⁹

Several kiwifruit allergens have been found to cross-react with birch pollen-specific IgE.^{6,7} Patients with clinical kiwifruit allergy have been shown to have positive skin prick test results and elevated IgE



Figure 1. A variety of kiwifruit that grows in colder climates and lacks the characteristic brown fur of the more familiar type.

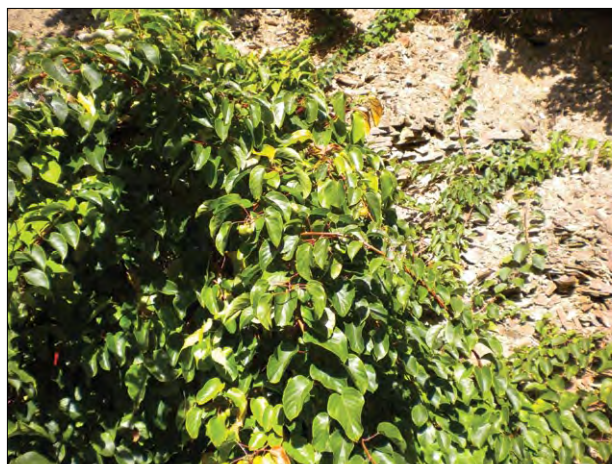


Figure 2. The growing plant of the kiwifruit.

to birch pollen. These patients also demonstrated higher concentrations of birch pollen IgE compared to patients with isolated birch pollen allergy.⁸

Latex allergy also has been associated with reactions to kiwifruit allergens, a component of the latex-fruit syndrome. Allergens from kiwifruit share common epitopes with allergens from latex, resulting in cross-reactions.⁹ Class I chitinases appear to play a role in this cross-reaction.¹⁰

Other cross-reacting allergens exist (Table); although birch pollen and latex often produce clinically overt reactions, many of the other allergens identified are only manifested by positive immunologic test results rather than in vivo signs or symptoms.

Testing for kiwifruit allergy may be necessary to establish the diagnosis, as patients may not realize the

Allergens That May Cross-react With Kiwifruit

| |
|--|
| Birch pollen ⁶⁻⁸ |
| Latex ^{9,10} |
| Pollen from timothy, mugwort, and olive ^{6,20,21} |
| Figs ²² |
| Avocado ⁹ |
| Banana ⁹ |
| Melon ²³ |
| Hazelnuts ²⁴ |
| Rye grain ²⁴ |
| Wheat flour ²⁵ |

association between contact with the fruit and onset of symptoms. Patients may demonstrate a marked erythematous and urticarial response following application of the pulp of the kiwifruit to scratched skin,¹³ but such testing should not be done unless the physician is prepared to treat anaphylaxis. It generally is advisable to begin with radioallergosorbent allergen testing, which is performed in vitro and carries no risk for anaphylaxis.

Clinical Uses

Fruits and vegetables can help reduce the risk for certain diseases, such as various cancers and cardiovascular disease,²⁶ and antioxidants commonly have been credited for these beneficial health effects.²⁷ The kiwifruit has been observed to have antioxidant activity, which directly correlates with its polyphenol and ascorbic acid content.²⁸ Both the peel and the pulp of the fruit are high in phenolic-reducing substances and flavonoids with great free radical scavenging activity.²⁹

The raw kiwifruit is rich in actinidin, which is commercially used as a meat tenderizer. A pilot study demonstrated a possible clinical use for the kiwifruit in the management of burn wounds.³⁰ In a rat model, applications of a fresh kiwi paste to full-thickness burns resulted in faster debridement, eschar separation,

and wound contraction when compared to a control group treated with a neutral ointment. Application of kiwifruit for debridement of human ulcers is complicated by concerns for allergy.³⁰

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