Identifying the Allergenicity of Maize Pollen in Iran

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Abstract

Background: Maize is a member of the Poaceae family, capable of producing large amounts of pollen grains which may constitute important allergens in spring and summer. The aim of this study was to determine the protein content of maize pollen and its allergenicity in guinea pigs.

Methods: The morphology of maize pollens was determined using light microscopy and scanning electron microscopy. The size of separated proteins was obtained by SDS-PAGE. A group of animals were immunized with maize pollen extract and the others were kept as control. After 40 days, the skin prick test was done in animals after blood sampling for counting the eosinophils. The allergenicity of proteins was identified by immunoblotting of transferred bonds using sera from sensitized guinea pigs.

Results: Pollen grains showed a spherical, monocrine structure with the scabrate exine surface. The SDS-PAGE indicated a major band of about 50kD. We also showed increase in flare and wheat diameter following skin prick test in sensitized guinea pigs along with an elevated number of eosinophils. The presence of group 13 allergen (Zea m13) with molecular weight of ~ 50kD was found in immunoblotting results.

Conclusion: This study showed one protein in maize pollen extract that could be considered as an allergen belonging to group 13 of allergen categories. However, further investigations should be scheduled for precise analysis of the proteins. This allergen can be used for diagnostic or therapeutic purposes (vaccination approaches) in allergic asthma patients.

Keywords: Allergenicity, allergen, maize pollen


Introduction

Maize is a member of the Poaceae family recognized as the most strategically and economically important plants which are used widely for different purposes such as food industries, extraction of oil and production of starch and ethanol. As one of the major cereal crops with good adaptation to different climate conditions, maize is cultivated in various parts of the world. Allergens are those antigens responsible for clinical allergic diseases. They are usually proteins or glycoproteins capable of inducing synthesis of IgE antibodies. Pollens and their proteins are one of the major prevalent sources of aero-allergens in the world. Despite the existence of more than 1000 different components in grass pollen, only a few can induce IgE-dependent allergic reactions.

Up to now, thirteen groups of grass pollen allergens have been identified. Recent reports indicated that groups one and thirteen are important allergens in maize pollen. The greatest reactivity has been shown between group 1 grass pollen allergens and allergen-specific IgE of sera from allergic patients (more than 90%). Group 13 allergens, with the polygalacturonase structure and molecular weight of 50 to 60 kD, have about 50% reactivity with allergic patients’ sera. Zm1 and Zm13 have been reported as representative maize pollen allergens of group 1 and 13 families in a mature maize pollen. Maize is a monocious plant (Figure 1). Male and female flowers are produced on a terminal tassel and lateral ears of the plant, respectively. Long branches and the central spike produce rows of short branches or paired spikelets (lower inset), each of the spikelets has two florets having three stamens. Maize is a wind and insect pollinated plant.

The Poaceae family have been reported as the most important causes of allergy during spring and summer. The major types of allergens belong to the Panicoideae, Chloridoideae and Pooideae subfamilies of the Poaceae family. Good adaptation of maize to different climate conditions has made its cultivation easy and worldwide. Therefore, the aim of this study was to evaluate the maize pollen allergenicity as occupational allergens between farmers exposed to maize pollen.

Materials and Methods

Scanning Electron Microscopy (SEM)
The morphology and structure of pollen were examined by scanning electron microscopy (philipsXL30).

Preparation of pollen extract
Fresh pollen was collected by shaking the tassels gently over a sheet of paper. Maize pollen (1 g) was incubated overnight in 20 mL of Phosphate Buffer Saline (PBS, PH = 7.2). The soluble fraction was isolated by centrifugation at 11000x for 45 minutes and dialyzed against double-distilled water overnight. The extract was then stored at 4°C until use. The protein content of pollen extract was then measured by the Lowry method.