

ALLERGENIC POLLENS AND SPORES IN THE WORKING ENVIRONMENT OF JAPANESE PEAR FARMERS

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Occupational allergies such as pollinosis are reported in several agricultural works in Japan. Many pollens and spores were observed in Japanese pear orchard during the artificial pollination season. By the study on daily symptoms in an allergic farmer, we confirmed that the pollinosis symptoms were most common and most severe during the artificial pollination. These results suggest that the exposure to allergenic pollens and spores induces allergic symptoms. Thus, caution should be paid for the avoidance of the exposure to these allergenic pollens and spores to prevent the allergy.

In Japanese fruit orchards, artificial pollination is a common technique in order to upgrade the fruit quality. However, previous studies have suggested that the exposure to pollens during the artificial pollination might cause serious respiratory diseases among the farmers (1). During artificial pollination season, the farmers have to perform very concentrated work, and pollinate the flowers by hand using Q-tips, during a limited pollination period. During this period, they are exposed to many allergenic pollen grains such as Japanese pear and various grasses. Consequently, some of them developed allergic symptoms. However, the exposure to airborne allergens in the orchards has not yet been well-studied.

In this study, we investigated the airborne pollens and spores in the orchard environment by volumetric method and analyzed the relationships between the exposure to pollens and spores and the symptoms in an allergic farmer. As a result, several kinds of airborne pollens and spores were assumed to be important to induce the allergic symptoms in the orchard.

MATERIALS AND METHODS

Airborne pollen surveys. We performed airborne pollen surveys using a personal volumetric air sampler (Personal Volumetric Air Sampler, Burkard, England) in a Japanese pear orchard, Toyama Prefecture, Japan. The air sampling was conducted at the center of the orchard by using the personal volumetric air sampler from April 1 to May 17, 2003. Thirty liters of air were drawn during 3 minutes. The pollens and spores were collected on the slide glass using a Vaseline application. They were identified and counted by using a microscope, after methylviolet staining. The concentrations of pollens and spores were expressed as number of grains per m³.

Study on the daily symptoms in an allergic farmer. The pollinosis symptoms were monitored daily in an allergic farmer, by using an allergic diary from April 1 to May 20, 2003. The farmer collected pear pollen from the anther, and she was

absented from work for several days before the process of artificial pollination. She hand-pollinated the pear flowers by using a kind of feathered Q-tip in the pear orchard (Fig. 1).

Comparison of the exposed allergens between the hand-pollination and the tool-pollination. Recently some farmers are using a mechanical spray to pollinate the pear flowers. Thus, we compared the pollens and spores between the two kinds of pollination methods, hand-pollination and tool pollination. The sampling was performed by using the volumetric sampler, which was hanging in front of the workers to assess their exposure to pollen.

Measurement of IgE antibodies to several allergens. IgE antibodies were measured by a modification of the RAST method (3, 4) in the allergic farmer. The allergens used were Japanese pear (*Pyrus purifolia*), Japanese cedar (*Cryptomeria japonica*), annual bluegrass (*Annual bluegrass*), other grasses (Pollen collected in Toyama Prefecture, mainly *Poa acroleuca*) and *Lycopodium* (*Lycopodium clavatum*) (Fig.2). The allergen discs were prepared using the allergenic extracts described by Coca (5). Informed consent was taken before the examination.

RESULTS

Airborne pollen surveys. In fruit orchards, we found many pollen grains such as Japanese pear, annual bluegrass (*Poa annua* L., a major species in the undergrowth of orchards) during the artificial pollination season (Fig.3). A small amount of the spores of *Lycopodium clavatum* (an extending agent for artificial pollination) was also observed. In early April, several pollen grains of Japanese cedar (*Cryptomeria japonica*) and *Cupressaceae* were also collected. Japanese cedar and *Cupressaceae* are common conifers and their pollens are important allergens for the Japanese general population.

The comparison of the exposed pollens and spores between the hand-pollination and the tool pollination is shown in Fig.4. A few pollen grains were collected during the pollen collection work. Many pollen grains and spores were trapped in both the tool pollination and the hand-

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pollination. Significantly, more spores of *Lycopodium* were collected in the case of the tool pollination than the hand-pollination (χ^2 -test, $p < 0.01$). Consequently, it was shown that the exposure to spore was increased by such technical renovation.

Study on the clinical symptoms in an allergic farmer. The clinical history and IgE antibody levels in an allergic farmer are shown in Table I. The clinical course of the daily allergic symptoms during the orchard work is shown in Fig. 5. Allergic symptoms occurred when the allergic farmer began to work and was exposed to pollens such as grasses in early April. However, the symptoms disappeared when she was absent from the farm work. The allergic symptoms occurred again, when she began to work on the artificial pollination. The symptoms continued during the artificial pollination work from April 18 to May 7. The allergic symptoms diminished from May 8 on, after the cutting of the grasses between trees, which reduced the airborne pollen grains of the grasses dramatically.

Table I. Clinical history and IgE antibody levels in the allergic farmer.

Allergic farmer (YA)
Age: 55 years old, Sex: female
Complaint: Seasonal allergic symptoms for 11 years
Duration of farm work: 36 years
Artificial pollination using Q-tips: 20 years
Artificial pollination using mechanical tools: 7 years
IgE antibodies (RAST score)
Japanese cedar: (0), Japanese pear: (1),
Annual bluegrass: (2), Spore of <i>Lycopodium</i> : (2)

DISCUSSION

In Japan, occupational allergies such as pollinosis are reported in several agricultural works (6). In such cases, cultivated species were emphasized to be a causative agent (7). However, several occupational pollinosis were reported to be related to environmental cross-reactive allergens (8).

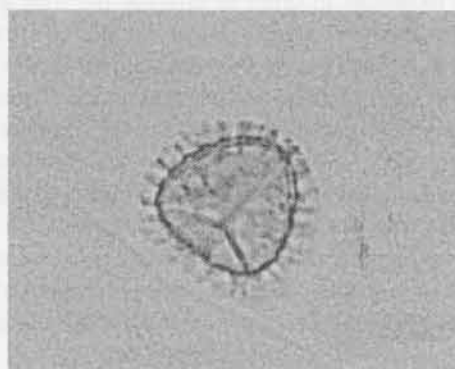
In the present investigation, it is clarified that farmers were exposed to not only pear pollen but also other pollens and *lycopodium* spores during artificial pollination. By a study on daily clinical symptoms by using an allergic diary, we confirmed that the pollinosis symptoms were common and most severe when she hand-pollinated the pear flowers.

In the pear orchard, in addition to the pear pollen a high concentration of grass pollens and of *Lycopodium* spores were also collected. The allergic farmer showed positive IgE antibody to *Lycopodium* by the RAST method. Consequently, it was demonstrated that the farmer was exposed to the *Lycopodium* spores, in addition to Japanese

Hand-pollination
Using feathered
Q-tip



Fig. 1. Hand pollination using a feathered Q-tip in the Japanese pear orchard.



Lycopodium clavatum

Fig. 2. A spore of *Lycopodium clavatum*.

pear, and were sensitized to these spores. *Lycopodium* was reported as an important allergen in the condom factory. (9) *Lycomodium* was also reported to be causative agent in a case of asthmatics who used *Lycopodium* in a dental clinic (10). In this study, we demonstrated that IgE antibody to *Lycopodium* by using the RAST method, and the exposure to *Lycopodium* is increasing in accordance with the common usage of the mechanical tools for artificial pollination.

In a previous study, we performed an epidemiological study of the pollinosis among the pear farmers in Toyama Prefecture and found that the prevalence of the pollinosis is about 10% (2). However, the prevalence of pollinosis is increasing recently. High prevalence was also reported in an occupational allergy to bell pepper pollen in the Netherlands (11).

These results suggest that the exposure to various allergic pollens and spores have important roles to induce the allergic symptoms among Japanese pear farmers during artificial pollination season. Further studies would be needed to clarify the combined effects of these pollens and spores, including the cross-reactivity of these allergens and the immunological mechanism of Th1 and

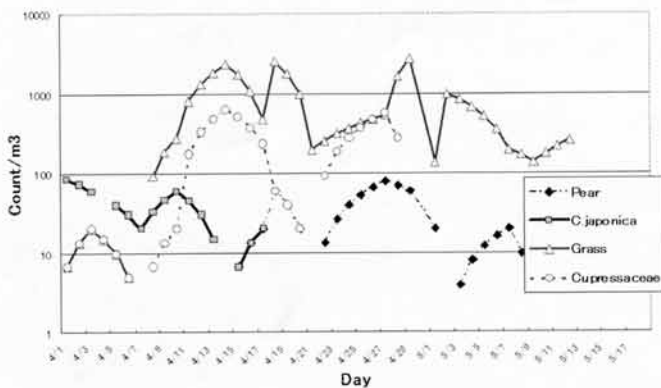


Fig. 3. Airborne pollens in the Japanese pear orchard.

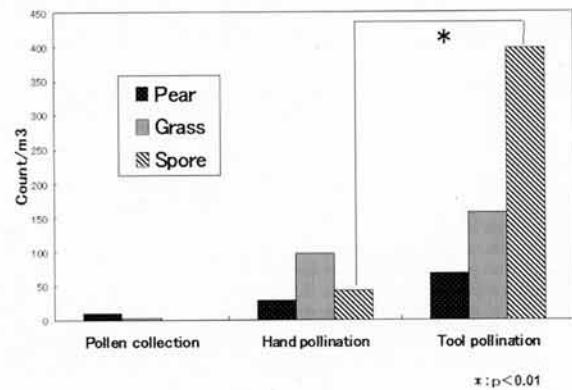


Fig. 4. Airborne pollens and spores by three types of work.

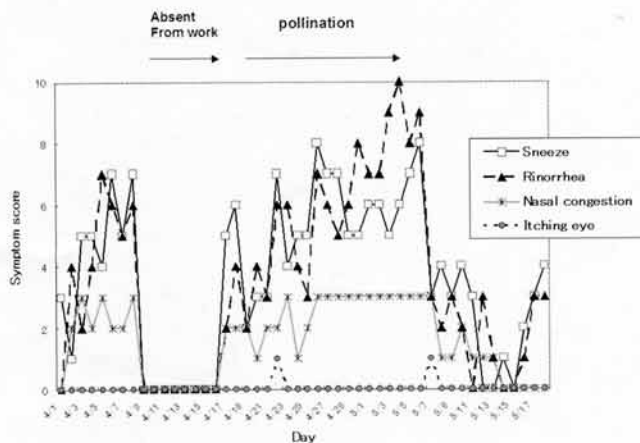


Fig. 5. Clinical course of the allergic symptoms.

Th2 imbalance (12). Though detailed etiology is not clear yet, caution should be paid to avoid such allergenic pollens and spores in the work environment.

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