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POLLEN ALLERGY DUE TO ARTIFICIAL POLLINATION OF JAPANESE PEAR.

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SUMMARY

In an epidemiological study on pollinosis among Japanese pear (*Pyrus pyrifolia* Nakai) farmers, the prevalence rates of allergic symptoms were found to be about 20%. Many airborne pollen grains of pear and annual bluegrass (*Poa annua* L.) were detected by an atmospheric pollen survey from April to June. A positive skin reaction to Japanese pear pollen was observed in 5.4% of farmers and to annual bluegrass was found in 31.5% of them. Seasonal allergic symptoms were observed among the farmers who showed positive reactions to pollens during the work period of artificial pollination from April to June. Specific Ig E antibodies were demonstrated in the sera of the farmers having pollinosis by radioallergo sorbent tests(RAST).

It was suggested strongly that an occupational allergy due to Japanese pear and/or annual bluegrass had been developed among Japanese pear farmers. This health hazard seemed to be an important problem connected with current agricultural renovation in Japan.

INTRODUCTION

In Japan, occupational pollinosis had been generally considered as a rare disease. However recently pollinosis has been found in some localities and some specific occupational conditions (Ishizaki, 1979). The first occupational pollinosis was found among apple farmers who had been engaged in artificial pollination in an apple orchard in Aomori Prefecture (Sawada, 1980).

Thus, we tried to investigate some of the epidemiological features of pollinosis among pear farmers in an orchard in Toyama Prefecture. We examined atmospheric pollens in the orchard, asked on symptoms of allergies, examined skin tests with pollen allergens and measured specific Ig E antibody to pollen allergens.

MATERIALS AND METHODS

1. Atmospheric pollen survey

An airborne pollen survey was conducted with a Durham's gravity sampling device (Durham, 1946) placed at a central site of the orchard from April to June, 1981.

2. Allergic symptoms

Ninety-six farmworkers engaged exclusively in pear orchards in Toyama Prefehture and joined to an association for Japanese pear productivity were selected to examine. Each farmer was interviewed according to a questionnaire designed specifically for this study in October 1980 (Teranishi, et al ., 1982). The main questions were related to individual history of occupation and experience of allergy-related symptoms, including asthma, rhinitis and conjunctivitis. Clinical symptoms were ascertained during the interview by a doctor.

3. Skin tests with pollen allergens

Japanese pear (*Pyrus pyrifolia* Nakai) and annual bluegrass (*Poa annua* L.) pollen grains were collected in the orchard. Pollen grains were extracted with Dextrose Phenol solution (Unger & Moore, 1932), dialysed with saline and sterilized by a millipore filter (Millipore corp. 0.45μm).

Intradermal skin tests were performed on the volar aspect of the forearm with the diluted solutions (1:1000w/v) of the extracts and saline as a control. Skin reactions after 20 minutes were judged according to Ishizaki's criteria (1969).

4. Radioallergosorbent tests (RAST)

Specific Ig E antibodies were measured by a modification of RAST described by Ceska et al. (1972). Allergen discs (500 pieces) were prepared by coupling pollen allergens (15mg) to cyanogen bromide activated paper discs. The concentration of allergen specific Ig E in serum was determined by incubating an allergen disc with 50μl of test serum sample and detecting bound Ig E with ^{125}I-labelled rabbit antihuman Ig E (Pharmacia AB, Sweden). RAST results were scored by comparing of disc-bound radioactivity of commercially available reference sera.

Total serum Ig E was determined by the Paper Radio Immuno-Sorbent Test (PRIST, Pharmacia AB, Sweden).

RESULTS

1. Atmospheric airborne pollens

As seen in Fig. 1, scattering of pear pollen grains was observed from April 23 to May 6.

Grass pollen, like annual bluegrass pollen was observed more abundant than pear pollen from April to June, during which the maximum pollen count was 150/cm²/day. The major fraction of total counts was constituted of the grass pollen grains.

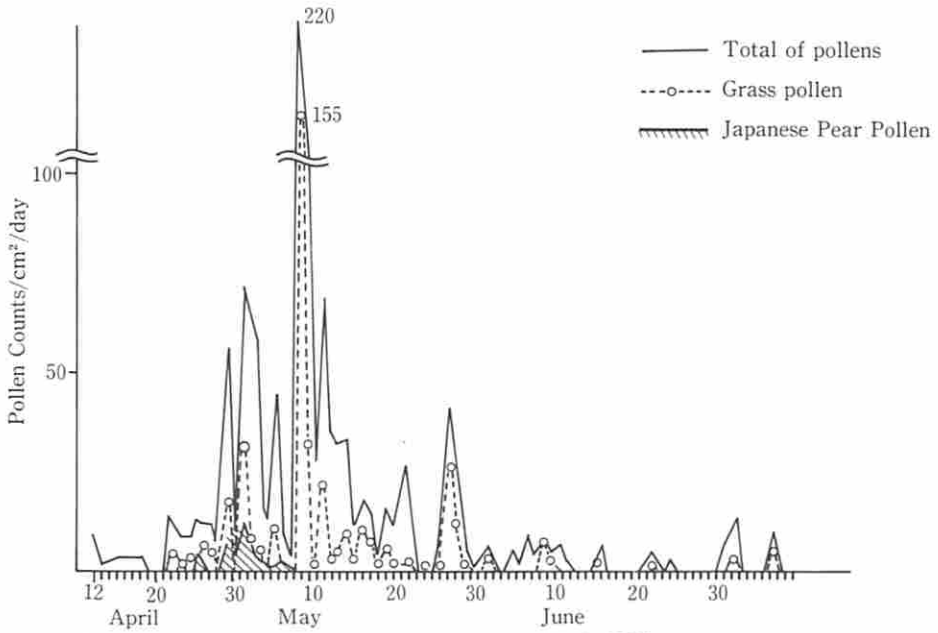


Fig. 1 Atmospheric pollen survey in a pear orchard, 1981.

2. Clinical manifestations

The distribution of the subjects by sex and age is shown in Table 1. 92(54 males and 38 females) of the farmworkers were willing to be interviewed and skin tested. Four others (3 males and one female) were not examined as they did not attend to the examination. Their average period of farmwork was 18 years (Table 2).

Of the 92 farmers interviewed, 21 (22.8%) complained about symptoms of allergic rhinitis such as sneezing, rhinorrhea and nasal obstruction, 17 (18.5%) workers reported symptoms of allergic conjunctivitis like itching and lacrimation of eyes. Asthma was present in one male and one female (Table 3).

3. Relation between clinical symptoms and duration of farmwork

The prevalences of nasal symptoms among the farmer groups classified according to the duration of farmwork is shown in Fig. 2. Nasal symptoms, Iike nasal obstruction, were observed statistically significantly higher among those who had worked for 11 to 30 years than other groups of farmworkers ($P<0.05$).

The prevalence of ocular symptoms for each group classified by duration of farmwork are shown in Fig. 3. The longer the duration of farmork, the higher the prevalence of ocular

symptoms.

Asthma was present in two persons who had worked for 14 years and 29 years. These symptoms had developed after the starting of farmwork.

Table 1 Age and sex distribution of the Japanese pear farmers.

Age group (years)	Male	Female	Total
30～39	30	22	52
40～49	18	13	31
50～59	9	4	13
Total	57	39	96

Table 3 Prevalence of clinical symptoms of Japanese pear farmers.

	Male(%)	Female(%)	Total(%)
Subject examined	54	38	92
Rhinitis	12(22.2)	9(23.7)	21(22.8)
Conjunctivitis	12(22.2)	5(13.2)	17(18.5)
Asthma	1(1.9)	1(2.6)	2(2.2)

Table 2 Duration of Farmwork.

Years of farmwork	No. of workers	Percentage of total
1～10	27	29.4
11～20	28	30.4
21～30	20	21.7
31～40	17	18.5
Total	92	100.0

Fig. 2 Nasal symptoms among the farmers classified accorcing to the duration of farmwork.

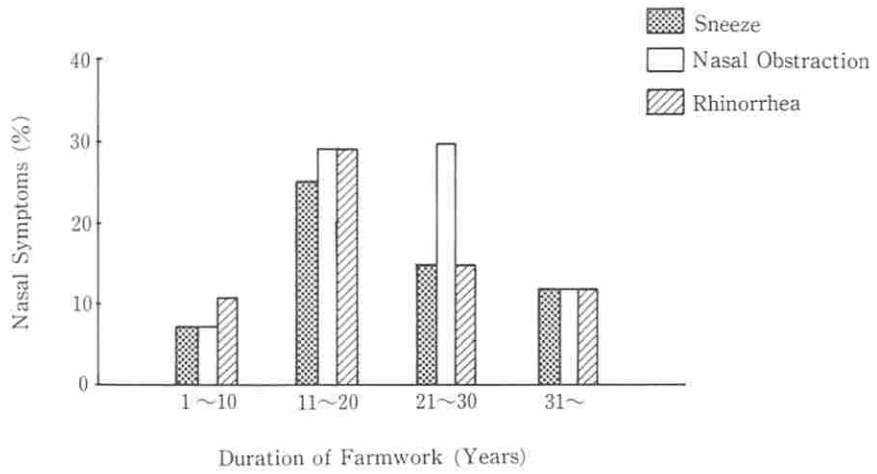
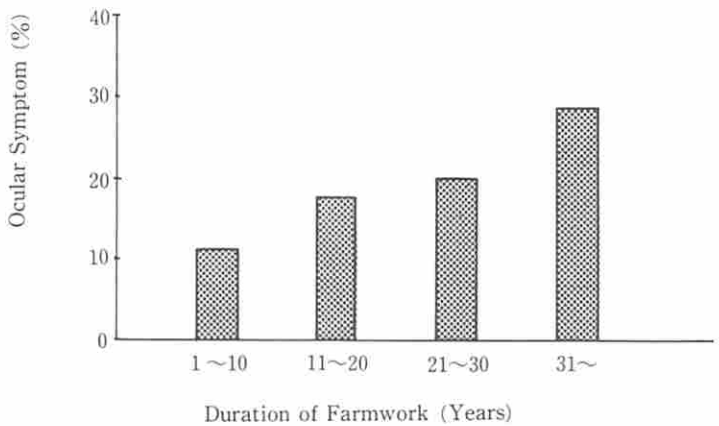


Fig. 3 Ocular symptoms among the farmers classified according to duration of farmwork.

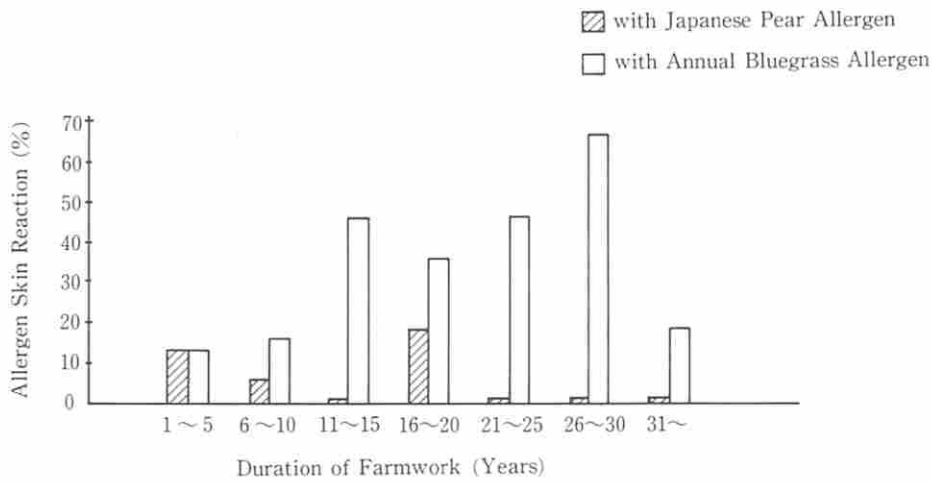


4. Allergy skin tests

Immediate skin reactions to pear pollen were positive in five workers (5.4%). Positive reactions to annual bluegrass were observed in 29 (31.5%) of the workers. All 5 workers who showed positive skin reaction to pear showed positive reaction to annual bluegrass also.

As shown in Fig. 4, the rate of positive skin reaction to annual bluegrass increased with increasing duration of farmwork. The positive rate of skin test with annual bluegrass was statistically significantly higher among the farmworkers who had worked for more than ten years than among the others ($p<0.05$).

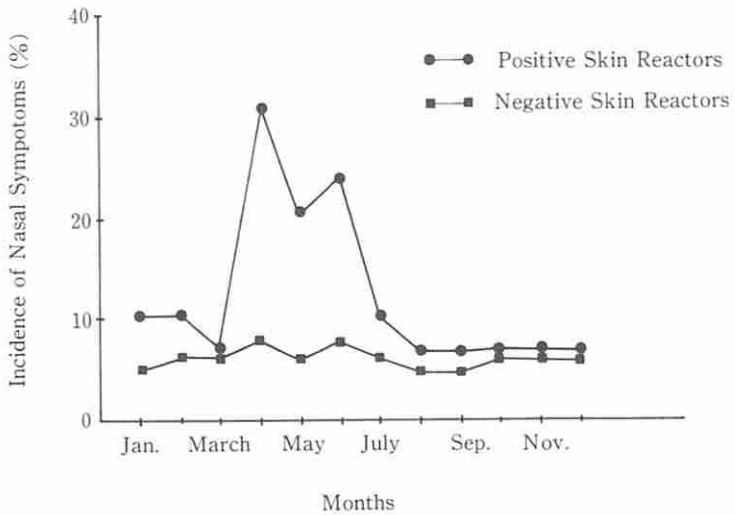
Fig. 4 Positive rates of the allergen skin tests among the farmers classified accoding to the duration of farmwork.



5. Seasonal changes of allergic symptoms

Fig. 5 shows the monthly changes of incidence of nasal symptoms. The peak of the incidence was observed from April to June. This was a season when Japanese pear blossomed and the flowers were hand pollinated. The peak was observed only among the positive skin reactors to annual bluegrass. Similarly, the incidence of ocular symptoms reached its peak in the same season and this peak was observed only among the positive skin reactors.

Fig. 5 Seasonal changes of the incidence of nasal symptoms among the positive skin reactors and the negative skin reactors toward annual bluegrass.



6. Serum levels of specific Ig E antibody

Ten pollinosis cases were diagnosed clinically by a doctor. All of them showed both of the positive skin reactions to either pollen and the seasonal allergic symptoms during the work. The symptoms included rhinitis, conjunctivitis and asthma. Table 4 shows the detail results for these ten pollinosis patients (five males and five females).

Table 4 RAST scores and clinical date of ten pollinosis cases.

	Sex	Age	No. of years worked	Clinical symptoms	Skin test		RAST score		Total IgE (U/ml)
					Japanese pear	Annual bluegrass	Japanese pear	Annual bluegrass	
case 1	M	35	18	N, O	±	+	1	3	300
case 2	M	39	23	N	−	+	0	1	300
case 3	M	44	29	N, O, A	−	+	0	2	76
case 4	M	50	34	N, O	−	++	0	2	120
case 5	M	52	30	N, O	±	++	0	2	120
case 6	F	36	13	N, O	−	+	0	2	84
case 7	F	37	14	N, A	±	+	1	1	4000
case 8	F	40	20	N, O	+	++	2	3	560
case 9	F	44	21	N	−	+	0	3	24
case 10	F	48	30	N, O	−	++	0	4	440

Notes : Clinical symptom……N : nasal
O : ocular
A : asthma

All of the pollinosis patients showed elevated serum Ig E antibody levels to either of the pollens. Clearly positive results (RAST≥2) were obtained in eight instances to annual blue grass and in one instance to Japanese pear.

DISCUSSION

In Toyama Prefecture, the Japanese pear had been cultivated in a primitive way since the 1900's. The cultivation techniques had been modernized rapidly after World War II. Intensive agriculture had been introduced and unification of the pear species had taken place to produce commercially valuable fruits in the 1960's. Consequently, the intermediary activity of insects for pollination had decreased by the use of large quantities of pesticides. As a result, artificial pollinbtion had come to be common and an inevitable activity.

The method of artificial pollination for Japanese pear plants was a simple hand operation of application of dried pear pollen, collected from the anthers of other pear species and placement on individual blossoms with a downy swab (Q-tip).

Many pear pollen grains of this entomophilous plant were observed wafting in the ambient air of the workers in the orchard as well as other grass pollen grains. Thus it was supposed

that the workers had been exposed to considerable amount of pollen grains during the artificial pollination.

We have reported elsewhere a case of pollinosis due to artificial pollination of Japanese pear (Teranishi et al.,1981). Recently two other cases of Japanese pear pollinosis have been reported. In one case, the allergic symptoms had obviously occurred by this type of occupational exposure to pollen grains (Tsukioka, et al. 1984).

This report, however, represents the first epidemiological study of pollinosis carried out among Japanese pear farmers. In this survey, about 20% of the farmworkers had symptoms of rhinitis and/or conjunctivitis. The prevalence of these symptoms was higher among farmers who worked more than 11 years than among those who worked 10 years or less. These findings suggested that some farmers had been exposed to pollen for 10 years or more before occurrence of the allergic symptoms to pollen.

In this survey, 5% of farmworkers showed positive skin reaction to Japanese pear pollen. It was interesting to note that some entomophilous pollen such as Japanese pear could cause allergic disorder in an occupational environment.

On the other hand, over 30% of workers showed positive skin reaction to annual bluegrass. The positive rate was correlated to the period of farmwork and positive skin reaction was more common among farmers who had worked more than 11 years than among those who had worked 10 years or less. This phenomenon suggests that the development of allergy to the pollen was dependent on the period of exposure in an orchard environment.

This annual bluegrass has been regarded as the common factor causing pollinosis in Poland (Weiss, 1965). In this survey, many grass pollen grains such as annual bluegrass were found by atmospheric survey and this species was found to be very common in the undergrowth of the orchard. Thus the pollen of this species was thought to be another important causal factor of the pollinosis among pear farmers.

In sera from pollinosis patients, We found high levels of specific Ig E antibodies to Japanese pear and/or annual bluegrass. Clearly positive RAST scores were obtained in eight instances to annual bluegrass and one instance to Japanese pear.

In this study, we could not perform any type of challenge test because it was considered inconvenient and hazardous in epidemiological studies. However, we could demonstrate specific Ig E antibodies to pollens by RAST technique. RAST has been reported as a useful method in the diagnosis of occupational allergens such as mites, (Reunala et al., 1983), proteases (Cartier et al., 1984), dyes (Yamada et al., 1978) and some plants (Toorenenbergen & Dieges, 1984). In this study, RAST was shown to be a useful method for detection of causal pollen allergens in the environment of farmworkers.

Based on these results, this study strongly suggests that Japanese pear farmworkers had been occupationally exposed to many pollens and some of them had developed an occupational pollinosis.

In Japan, artificial pollination has been carried out not only for Japanese pear but also for the other pomiculture species. The high prevalence of pollinosis reported here indicates that

further study is needed to elucidate these work-related health hazards among the farmworkers from the view point of occupational health.

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