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AEROBIOLOGICAL AND CLINICAL STUDIES ON ALLERGENIC POLLENS IN TOKYO AREA

BY

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ABSTRACT

Pollen surveys in Meguro, Tokyo, carried out by the gravity slide method from 1965 to 1967, confirmed the trace of dispersal of allergenic pollens.

In this area, the pollinating period of the airborne pollen began in late January and ended in November. There were three pollen seasons. The tree pollen season was observed from February to May, the grass pollen season from May to October and the ragweed pollen season from August to September. The prevalent pollens were the Japanese cedar, pine, Gramineae family and short ragweed.

Intradermal test with four commercial pollen extracts and a control were performed on 129 patients with nasal allergy.

Rate of positive skin reactivity to individual pollen allergens was: short ragweed 33.3%; Japanese hop 12.4%; Japanese red pine 10.8%; Japanese cedar 10.1%.

The combined aerobiological and clinical data suggest that in the Tokyo area there are significant hay fever plants and positive skin reactors.

INTRODUCTION

More than 100 years have elapsed since Blackley[1] began working with pollen allergy. Although, in the intervening years, more than 40 articles dealing with the botanical aspects of inhalant allergy have been published in Japan, none on cases of pollinosis had been reported until 1961. Also the first recorded pollen survey in Tokyo and in Kobe, which was done by Hara[2], failed to disclose any trace of allergenic pollen. Therefore, it had been believed for a long time that pollinosis is unknown in Japan. However, from the appraisal of recent researches comes the conclusion that pollinosis is found in Japan and pollens of possible importance have been found by air sampling.

Since 1961, several kinds of pollinosis have been reported in Japan. The first reported clinical case of pollinosis was ragweed pollinosis which was reported by Araki[3] in 1961. In 1964, Horiguti and the author[4]

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reported on 21 cases of Japanese cedar pollinosis. Grass pollinosis was reported by Sugita and Furuya[5] in 1964 and by Shida et al.[6] in 1965 and 1968. In addition, Japanese hop pollinosis was reported by Horiguti and the author[7] in 1968. Short-term pollen surveys in Tokyo were carried out previously by Hara[2] in 1939 and by Araki[8] in 1960.

Nowadays, it is being increasingly recognized that pollen allergens are capable of causing allergic respiratory diseases. Precise knowledge of allergenic pollens provides an indispensable aid in the diagnosis and treatment of pollinosis. Recognition and evaluation of the role played in pollinosis by the various pollens is usually accomplished by means of pollen surveys.

Since 1964, the long-term pollen survey in Tokyo has been made by the author. The present studies are concerned both with the aerobiological and clinical aspects of pollen allergens in Tokyo. The conclusion, then, are limited to the pollen content in the air and the rate of positive skin reactivity to pollen extracts.

Materials and Methods

Aerobiological studies

During the years 1965, 1966 and 1967, a standard gravity slide sampler (Durham[9] pollen sampler) was operated at a level of 1.5 meters above the ground in Meguro which is situated in the south-western area of Tokyo. Vaseline-coated glass slides were exposed in the sampler for 24 hours beginning at 8 A.M. each day. Following exposure, several drops of Calberla's Solution were placed on the slide and a 24×32 mm cover glass applied. Calberla's Solution contains 5 ml glycerin, 10 ml 95% ethanol, 15 ml distilled water, and two drops of a saturated aqueous solution of basic fuchsin. The whole area included under the cover glass was examined microscopically under low power magnification. Dividing the total count by 7.68 gives the average number of pollen grains per square centimeter.

Clinical studies

With the use of four commercial allergen extracts and a control (allergen extract Torii from Torii & Co., Ltd., Nihonbashi, Tokyo), intradermal tests were performed on 129 new patients at the allergy clinic of the department of otorhinolaryngology, Tokyo Medical and Dental University. All patients had symptoms suggestive of nasal allergy and the nasal smears by Giemsa's staining or Hansel's staining showed eosinophilia. The following extracts were used: Japanese cedar pollen, 1:1000; Japanese red pine pollen, 1:1000; short ragweed pollen, 1:1000; Japanese hop pollen, 1:1000; and a phenolated saline control. Intradermal tests were done on the anterior forearm with 0.02 ml of each allergen extract. Test sites were read after 15 minutes

and positive reactions were interpreted as a wheal greater than 9 mm or as a erythema greater than 20 mm.

Results

The results of daily atmospheric pollen survey during 1965 to 1967 are given in Figure 1. Pollinating period of airborne pollens began in late January and ended in November. There were marked day-to-day and seasonal variations in pollen counts. Tree pollen season was observed from February to May, grass pollen season from May to October, and ragweed pollen season from August to September. The prevalent pollens were Japanese cedar, pine, Gramineae family and short ragweed.

With the Japanese cedar and short ragweed which are of the first importance, the pollinating periods, the highest counts and their dates are shown in Tables 1 and 2.

Rate of positive skin reactivity to pollen allergen extracts is shown in Table 3.

Table 1. Pollinating period, peak date and highest count of Japanese cedar

Year	Pollinating period	Peak date	Highest count
1965	Feb. 13—April 27	March 12	81
1966	Feb. 18—April 10	March 5	59
1967	Feb. 27—April 15	March 2	52

Table 2. Pollinating period, peak date and highest count of ragweed

Year	Pollinating period	Peak date	Highest count
1965	Aug. 27—Sept. 13	Aug. 30	6
1966	Aug. 14—Sept. 13	Aug. 27	3
1967	Aug. 8—Sept. 9	Aug. 15	3

Table 3. Rate of positive intradermal test with pollen allergens on 129 patients with nasal allergy

Pollen allergens		Intradermal test	
Botanical name	Common name	No. of patients reacting	%
Ambrosia artemisiiforia	Short ragweed	43	33.3
Humulus japonicus	Japanese hop	16	12.4
Pinus densiflora	Japanese red pine	14	10.8
Cryptomeria japonica	Japanese cedar	13	10.1

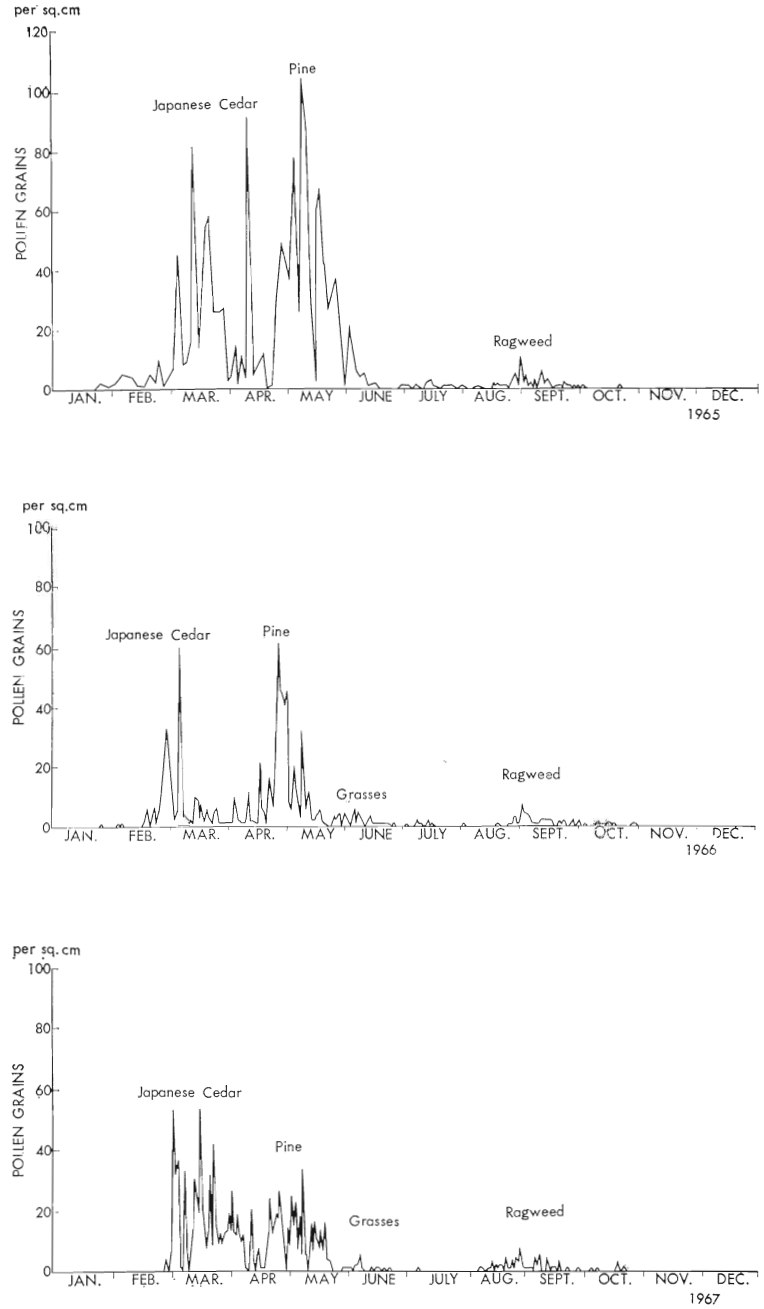

Fig. 1. Daily atmospheric pollen survey during 1965 to 1967 in Meguro, Tokyo.

Discussion

None of the cases of pollinosis had been reported in Japan until 1961. Why had it been recognized that there were not any pollinosis in Japan? It was fundamentally because of the lack of investigation on pollinosis and allergenic pollens in this country. Although the systematic air sampling in Tokyo and in Kobe had been done by Hara[2] during 1936, it failed to disclose any trace of allergenic airborne pollen. After this no systematic pollen survey had been done until 1960. In addition, geographic features, climate and intensive cultivation of arable land have kept the growth of weeds and grasses in this country to a minimum. Furthermore, heavy rainfall at frequent intervals tends to prevent the aerial dispersal of any sort of pollen. Therefore, it had been believed for a long time that pollinosis was unknown in Japan.

However, in 1964, Horiguti and the author[4] were the first to report on Japanese cedar pollinosis in Japan. In this report, it was emphasized that the pollen survey could help in making the diagnosis of this pollinosis. A short-term pollen survey in Tokyo was also reported previously by Horiguti and the author[10] in 1965. The importance and necessity of pollen survey were emphasized in these reports.

Nowadays, the botanical surveys, particularly systematic pollen surveys, are being carried out by the botanists and the allergists in several different areas of this country. In 1960, Araki[8] demonstrated first of all that the ragweed pollen was found in Tokyo and the pollen concentrations were generally lower, but not so extremely lower than those in the United States. Ikuse et al.[11] observed that the prevalent pollens in Narashino City, situated in the vicinity of Tokyo, were Japanese cedar and short ragweed.

A recent report by Furuya[12] in Sagamihara City, a rural district near Tokyo, revealed the tree pollen season and grass-weed pollen season to be of greatest significance. Predominant pollen grains were Japanese cedar, Chamaecyparis sp., pine, Miscanthus sinenis and wormwood. The very recent report by Wagatsuma et al.[13] has extended the knowledge of hay fever plants to the island of Hokkaido, Japan. The deciduous trees and conifers pollinate there from April to June, grass from June to August, and weed from June to September.

The author's data showed that the pollinating period of airborne pollen in Tokyo began late in January and ended in November. The tree pollen season began late in January with the Japanese cedar and ended late in May with the Japanese pine. Predominant pollen grains were Japanese cedar (*Cryptomeria japonica*). Chemaecyparis sp., and Pinus sp. (*Pinus Thunbergii* and *Pinus densiflora*).

Japanese cedar (Figs. 2 and 3), which is native of Japan, is one of the typical conifers and is found almost throughout the country except in Hokkaido. The season is from February to April. Many cases of Japanese cedar pollinosis were reported by Horiguti and the author[4] in 1964. Further studies on Japanese cedar pollinosis were reported by Horiguti and the author[14,15] in 1965 and in 1967. Although, the rate of positive skin reactivity to Japanese cedar pollen extract was relatively low, the combined aerobiological and clinical data suggest that the Japanese cedar may be the most important tree in Japan.

Pine pollen does not appear to produce pollinosis although it is produced in abundant quantity.

There are some grasses in Tokyo but all are of minor importance. The important grasses, chiefly timothy (*Phleum pratense*) (Figs. 4 and 5) and orchard grass (*Dactylis glomerata*), are found in the northern part of Japan, especially in Hokkaido. Shida et al.[6,16] reported on many cases of grass pollinosis in Hokkaido.

Among the weeds in this area, ragweed, mainly short ragweed (*Ambrosia artemisiifolia*) (Figs. 6 and 7), is the most important plant with the season lasting from early August to late September. Ragweeds are not native of Japan. Only three species, short ragweed, giant ragweed (*Ambrosia trifida*) and western ragweed (*Ambrosia psilostachya*), of 100 or more Ambrosiaceae of North America are reported as having been introduced into Japan. Short ragweed has been expanding gradually in its distribution and may be found almost everywhere in the suburbs of the big cities such as Tokyo, Yokohama, Nagoya and Osaka. Giant ragweed and western ragweed, however, are only found sporadically. Okuda et al.[17] demonstrated the procedure of diagnosis and treatment of ragweed pollinosis and emphasized that both diagnostic skin test and nasal provocation test can help in making a diagnosis of nasal allergy. In the author's data, the rate of positive skin reactivity to ragweed pollen extract was the highest of all the pollen extracts. Then, the combined aerobiological and clinical data suggest that the short ragweed may become increasingly important in Tokyo.

Japanese hop (*Humulus japonicus*) (Figs. 8 and 9), which is found almost everywhere in Japan, pollinates from September to October, but apparently produces few clinical cases. The first recorded case of Japanese hop pollinosis was reported by the authors[7] in 1968.

The author[18] suggested in the earlier report that the inhalant allergens such as house dust, pollens and molds might be of prime importance in Japan. As for pollen allergens, the authors[19,20] demonstrated that the plants which produce them have been found almost everywhere in Japan.

It should be emphasized that the ideal pollen survey which combines careful field observations over several seasons with systematic and regular

annual aerobiological studies should be done everywhere in Japan.

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Fig. 2. Japanese cedar (*Cryptomeria japonica*)

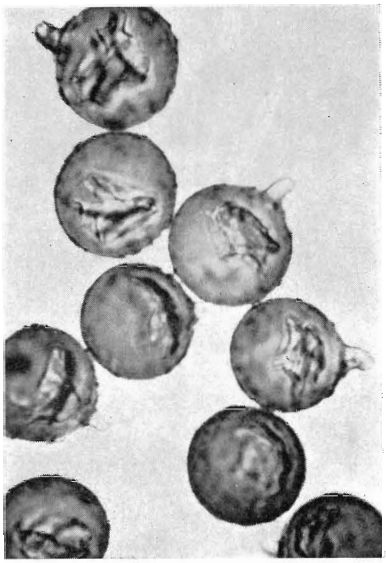

Fig. 3. Pollen grains of Japanese cedar (29μ)

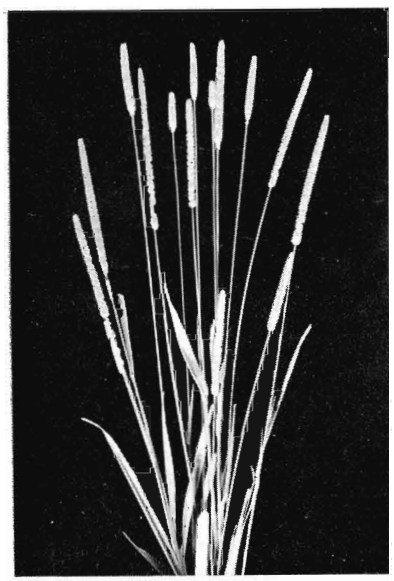

Fig. 4. Timothy (*Phleum pratense*)

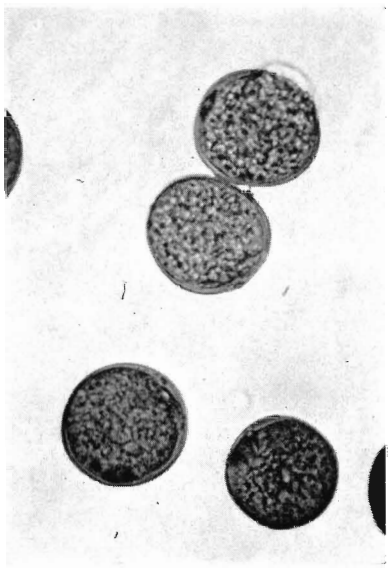

Fig. 5. Pollen grains of timothy (34μ)

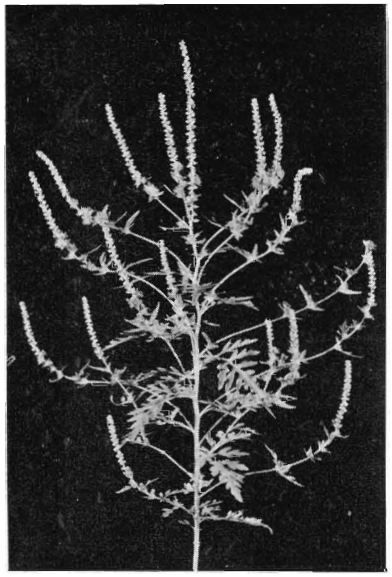

Fig. 6. Short ragweed (*Ambrosia artemisiiforia*)

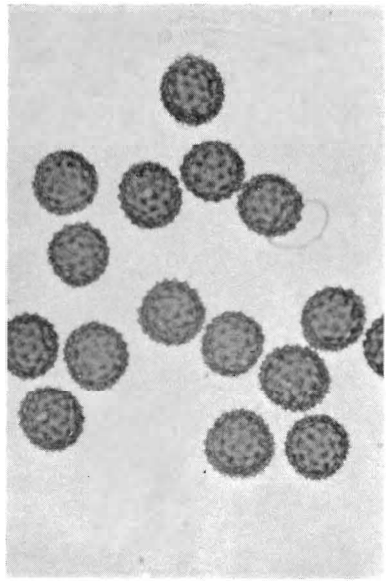

Fig. 7. Pollen grains of short ragweed (20μ)

Fig. 8. Japanese hop (*Humulus japonicus*)

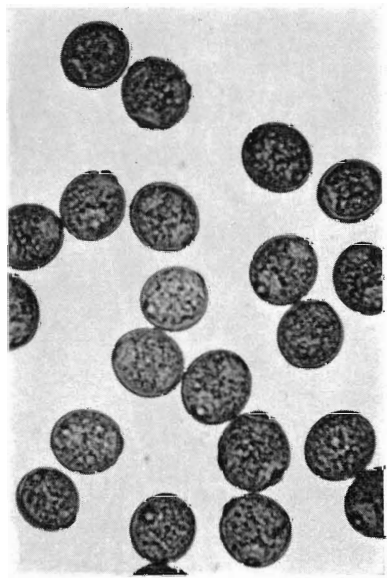

Fig. 9. Pollen grains of Japanese hop (20μ)