

# Allergic Conjunctivitis Caused by Sugi (*Cryptomeria japonica* D. Don) Pollen out of Season

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Sugi (Japanese cedar) pollen is a major allergen responsible for many cases of allergic conjunctivitis.<sup>1</sup> Sugi is an endemic conifer in Japan and the species responsible is *Cryptomeria japonica* D. Don. In the spring, many patients in Japan consult ophthalmologists for red, itchy eyes with discharge. We see this in the Chiba area in which our hospital is located, where sugi trees scatter pollen.<sup>2</sup> Taira<sup>3</sup> reported that sugi pollen was scattered not only during the spring, but in all four seasons, and especially between October and December. Thus although the allergic conjunctivitis caused by sugi pollen is considered to be strictly a "spring disease", we prospectively studied patients with allergic conjunctivitis caused by sugi pollen to determine the monthly patterns for the possibilities of the development of the allergic conjunctivitis caused by sugi pollen throughout the year. We also investigated the growth of sugi male cones in November for four consecutive years.

## MATERIALS AND METHODS

Patients who were diagnosed with allergic conjunctivitis at Tokyo Dental College, Chiba, Japan, be-

**SUMMARY** Allergic conjunctivitis caused by sugi pollen is considered to be strictly a "spring disease". However, a recent report indicated that sugi pollen is scattered not only in spring but in all seasons, especially in the autumn. We retrospectively determined the number of patients with allergic conjunctivitis caused by sugi pollen during each month for 3 consecutive years, and also investigated the growth of sugi male cones in November for four years. Diagnosis of allergic conjunctivitis was based on symptomatic complaints, clinical findings, and serum sugi pollen specific IgE measured by the Multiple Antigen Simultaneous Test 16. The annual incidence of allergic conjunctivitis peaked twice, once in spring and again in autumn. Scattering of sugi pollen occurred mostly in March and October, whilst the growth of sugi male cones was highest in November. Thus, allergy to sugi pollen can cause allergic conjunctivitis both in the spring and late autumn.

tween January 1991 and December 1993 were included in this retrospective study. The diagnosis of allergic conjunctivitis was based on our conventional criteria of the presence of ocular symptoms, results of clinical examination, and positivity for specific serum IgE ( $>1.01$ ; Lumino Counter 100). Ocular symptoms of allergic conjunctivitis were redness of the conjunctiva, itching, discharge, and epiphora. Clinical examinations variously revealed conjunctival injection, edema, filamentous (mucous) discharge, and papilla formation on the palpebral conjunctiva.<sup>4</sup>

Serum levels of antigen specific IgE were measured with a com-

mercial Multiple Antigen Simultaneous test (MAST 16; SRL Inc., Tokyo, Japan), which is an enzyme-linked immunosorbent assay (ELISA) system that uses 16 monoclonal antibodies.<sup>5,6</sup> The antigens included house dust, dust mites, egg white,

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soybean, ragweed mix I, mugwort, sweet vernal, timothy, Japanese sugi pollen, *Penicillium*, *Cladosporium*, *Candida*, *Alternaria*, *Aspergillus*, and antigens from cats and dogs. A serum concentration of specific IgE antibody above 1.01 was considered positive.

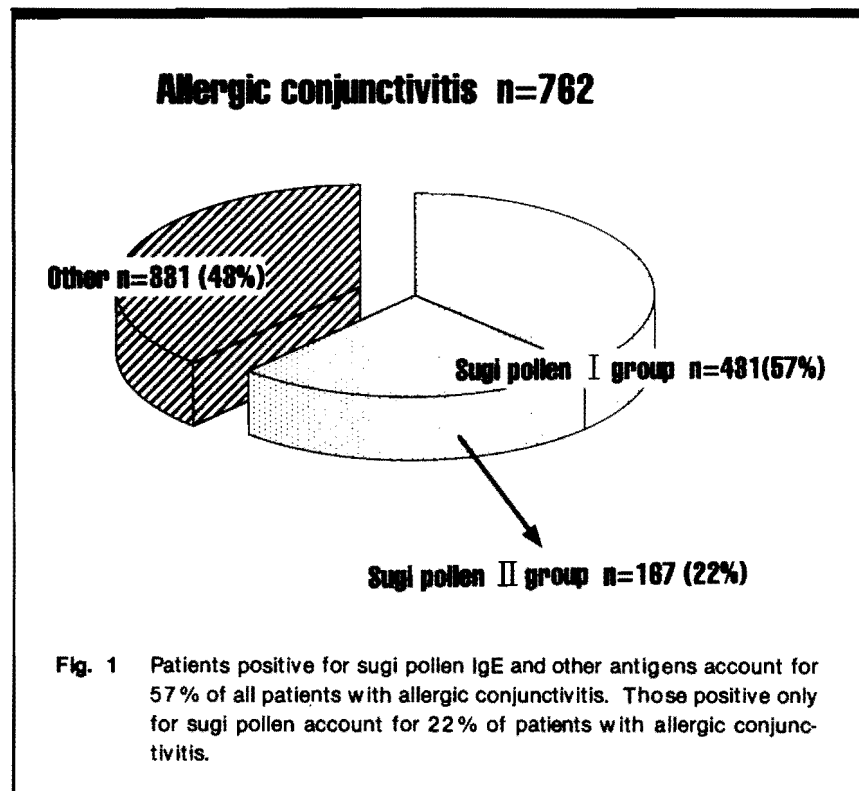
Patients who were positive for sugi pollen IgE as well as for other antigens were considered susceptible to allergic conjunctivitis caused by sugi pollen; this group was designated sugi pollen I. Patients who were positive only for sugi pollen IgE were considered to have definite allergic conjunctivitis caused by sugi pollen; this group was designated sugi pollen II. We compared the number each month and incidence of those patients with allergic conjunctivitis caused by sugi pollen. The monthly incidence was designed for monthly numbers of sugi pollen positive cases as a percent of total monthly patients with allergic conjunctivitis.

We obtained the average temperatures in Chiba from the meteorological observatory monthly from 1991-1993. We also investigated scattered sugi pollen using the Durham type pollen trap,<sup>7</sup> which is a simple and suitable for long time investigation without influences of rain or dust, and investigated the growth of sugi male cones in November for four consecutive years using one replication everyday.

## RESULTS

We identified 762 patients (341 males and 421 females; age range 4 to 84 years) with allergic conjunctivitis during the 3 year period, which was approximately 5% of our outpatient population. Of these 762, 431 (57%) were positive for sugi pollen IgE, including 167 patients who were solely positive for sugi pollen (sugi pollen II; 22%) (Fig. 1).

The total number of patients who were seen for allergic conjunctivitis peaked three times a year:



March through April, June through July, and October through November. Patients with sugi pollen I were seen in all seasons; their visits also peaked three times: in early spring, summer, and late autumn. The number of patients in sugi pollen II group showed two peaks annually in March and November (Fig. 2).

The monthly incidence (percent of total monthly patients with allergic conjunctivitis) in patients in the sugi pollen I group was high in all seasons and had two annual peaks; February through March and again in November. The number of sugi pollen II group similarly exhibited two peaks, one in spring and the other in autumn (Fig. 3).

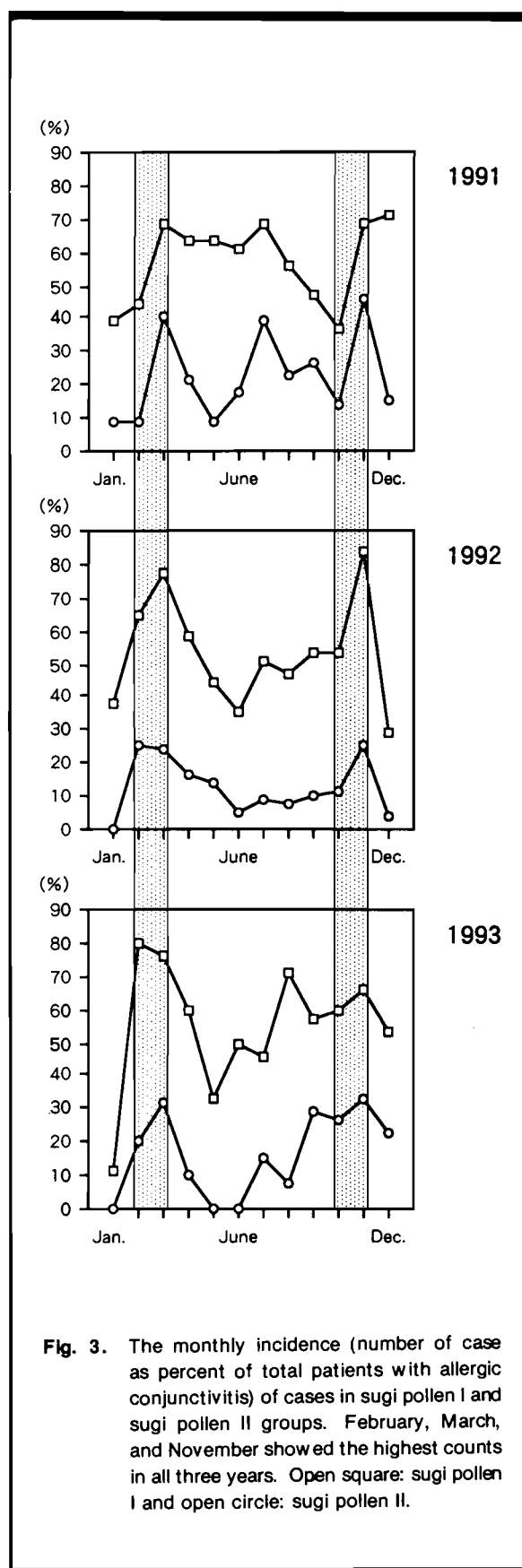
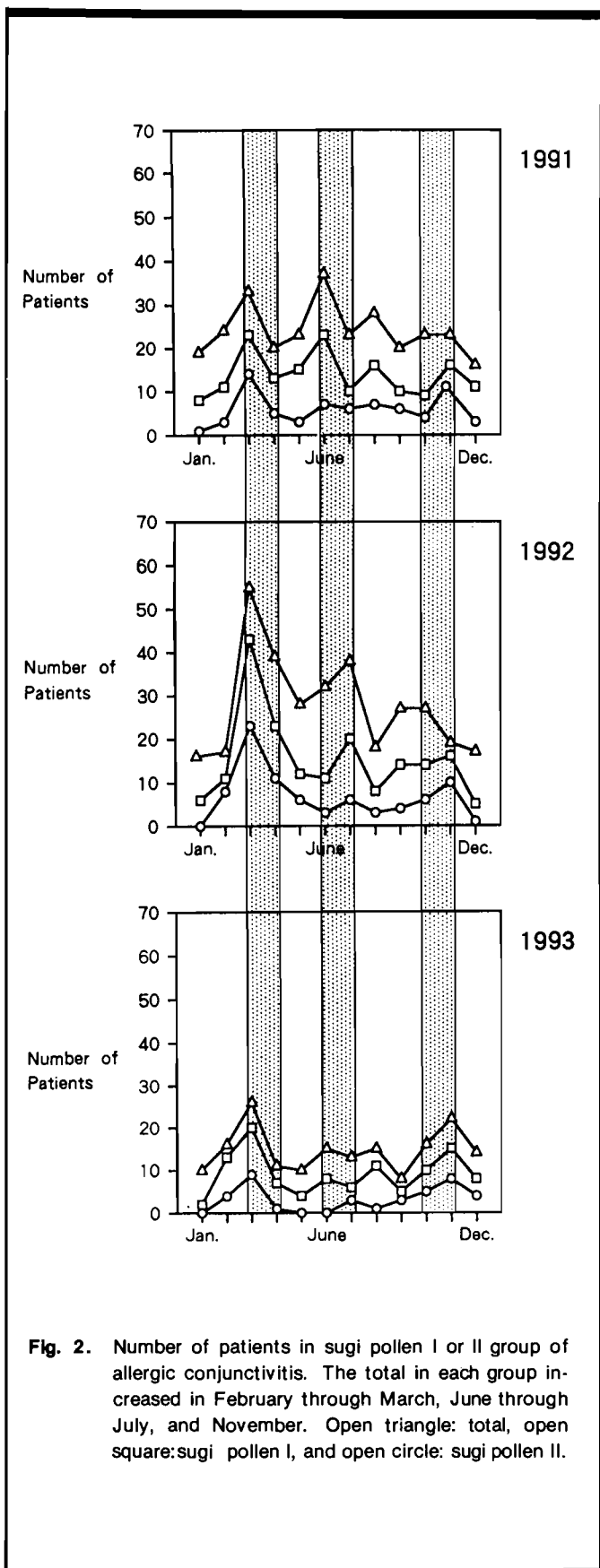
The average temperatures in Chiba during the months of March and November of 1991-1993 were similar: 9.1°C and 12.5°C in 1991, 9.3°C and 13.0°C in 1992, and 7.4°C and 13.9°C in 1993, respectively. Sugi pollen was scattered especially in February through April and in

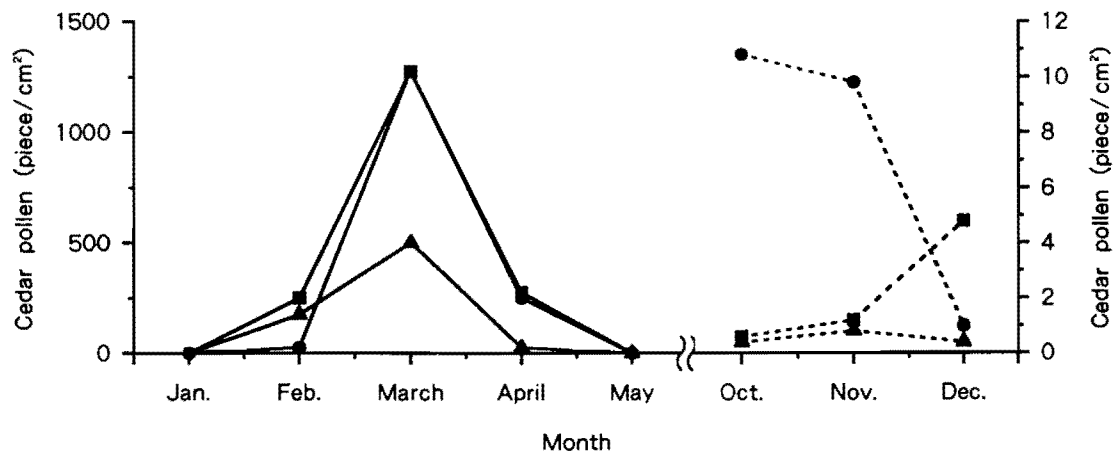
October through December (Fig. 4). Its male cones grew mainly in November (Table 1).

## DISCUSSION

Allergic conjunctivitis is a widespread and clinically significant disease that affected 5% of our outpatients over the 3-year period surveyed. It affected all age groups in Japan, in the northern part of America, and in Europe. In the area around Chiba Prefecture, where the sugi pollen count is high in spring, the incidence of allergic conjunctivitis caused by sugi pollen is the highest in Japan for that period.<sup>2</sup>

Allergic conjunctivitis is associated with seasonal factors, with the antigen being a key factor.<sup>8</sup> We measured the positivity for 16 typical atmospheric airborne antigens in this study.<sup>9</sup> Patients sensitive to other antigens plus sugi pollen (sugi pollen I group) were susceptible to allergic conjunctivitis caused by sugi





**Fig. 4** Scattering of sugi pollen in Chiba area from the spring of 1991 through autumn of 1993. Sugi pollen was scattered especially from February through April. A small amount of sugi pollen was scattered in autumn. Vertical axis label means sugi pollen number in 1 cm<sup>2</sup> plate scattered by Durham type pollen trap. Closed square: sugi pollen 1991, closed triangle: sugi pollen 1992, and closed circle: sugi pollen 1993.

**Table 1.** Growth of sugi young branch with male cones in November from 1990 to 1993 (average of 150 samples).

Day examined	Weight of a male cone (mg)	Longitudinal length of a male cone (mm)	Length of a branch of male cone (cm)	Number of male cone in a branch (number)
Nov. 27, 1990	29.42	7.2	2.5	28
Nov. 25, 1991	23.25	6.6	2.8	22
Nov. 20, 1992	22.94	6.6	2.1	24
Nov. 30, 1993	21.95	6.0	2.1	14
Mean±SD	24.39±3.4	6.6±0.5	2.4±0.3	22±5.9

pollen, but other antigens may have influenced the in allergic reactions. The allergic conjunctivitis in patients who were positive only for sugi pollen-specific IgE (sugi pollen II group) was likely due to the sugi pollen allergy.<sup>10</sup>

Patients with sugi pollen-specific IgE accounted for 57% of our cases of allergic conjunctivitis, about one-fourth of our patients

were positive only for sugi pollen (Fig. 1). While sugi pollen is thought to be a clinically important and widespread allergen in patients with allergic disease in Japan,<sup>11</sup> as well as in North America and in Europe, this result may mean that allergic patients have serum IgE not only for sugi pollen but also for other airborne allergens.<sup>12</sup>

Patients who showed positi-

ty for sugi pollen allergy were encountered in all seasons (Fig. 2). Housedust and mites are thought to increase in June. The number of patients positive for sugi pollen-specific IgE also increased in June partially due to the rainy season. Incidence of sugi pollen II group, who are thought to be really allergic conjunctivitis caused by sugi pollen, peaked in March and November (Fig. 3). Thus, while the initial peak of allergic conjunctivitis in the spring was specially due to sugi pollen, the second peak in June may be due to antigens such as housedust or mite.

The average temperatures in Chiba in March and November, when sugi pollen group peaked, are similar; almost at 9–11°C. Taira<sup>3</sup> found that a discernible amount of sugi pollen was scattered from the middle of October through December. In his study, sugi male cones collected in October and November bloomed when incubated at 5°C to 20°C after low-temperature treatment.<sup>3</sup> Although a small number of male flowers from sugi trees bloomed and scattered pollen under such

conditions, the proportion depended on the stage of growth and conditions of incubation.<sup>3</sup> Sugi trees bloom and scatter their pollen at those temperatures about 10°C. Our study also showed that sugi pollen was scattered in the spring and autumn (Fig. 4). Although the amount of pollen scattered in autumn was relatively very small (at most 11 numbers/cm<sup>2</sup>) the male cones had actually developed and this could affect the allergic patients (Table 1).

Although the sugi pollen count was lower in the autumn than in the spring, it may have been sufficiently high to induce allergic reactions. Why such small amounts of pollen invoke symptoms during autumn compared with the much larger pollen concentrations in spring is unknown. Probably, the reason may not related to patients' sensitivity or pollen or pollen dose, but the presence of sugi pollen itself or not.<sup>13-15</sup>

Many allergic conjunctivitis due to tree or sugi pollens are considered to be seasonal restricted diseases. Clinicians should have the knowledge that sugi pollens can be scattered through the year. Thus, allergy to sugi pollen is a concern in all seasons, especially in the early spring and late autumn.

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