

原 著

千葉県における空中浮遊花粉の季節的変動(3)

スギ花粉 3年間(1978-1980)の年次的変動

幾瀬マサ*・佐橋紀男*・松田章孝*・鈴木奈雅子*

Seasonal fluctuations of the airborne pollen grains
& spores in Chiba Prefecture (3)Fluctuations in 1978-1980 of *Cryptomeria japonica*Masa IKUSE*, Norio SAHASHI*, Akitaka MATSUDA* and
Nagako SUZUKI*

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The fact that the allergen of pollinosis is the pollen grains of *Cryptomeria japonica* (Japanese cedar pollinosis) was found for the first time in the district of Nikko, Tochigi Prefecture in 1964¹⁾. Recently in Japan, this pollinosis has been reported as one of the noticeable allergy²⁾³⁾⁴⁾. Especially in 1979, the number of the patients increased to the utmost. However, the positive remedy for Japanese cedar pollinosis has not fixed until now. The present study has been done one of the attempt to consider the relationship between the number of *Cryptomeria japonica* pollen grains and the total number of the patients of pollinosis through the period of the pollination.

During three seasons of Japanese cedar pollinosis from 1978 to 1980, the dispersal airborne pollen grains of *Cryptomeria japonica* were collected at four urbanized areas in Chiba Prefecture, and investigated the variation of the total number of the pollen grains per two days (48 hours) during each season in each area. From the results of this survey, the authors got some noticeable facts to clarify the relationship between the total number of the pollen grains and the four urbanized areas' situations.

Futhermore, the investigation of the hourly variation of *Cryptomeria japonica* pollen grains has been done in the full pollination period both in 1979 and 1980. From the results, the authors found the close relations between the hourly total number and the effect of the humidity.

* 東邦大学薬学部 〒274 船橋市三山2-2-1

* School of Pharmaceutical Science, Toho University, Funabashi, Chiba Pref., 274 Japan.

Methods

The standard pollen-slide shelters were set at four urbanized areas (Fig. 1), i.e. Funabashi city (reported as Narashino city in the previous papers⁵⁾⁶⁾), on the roof-floor (15m. above the ground) of Toho University ; Sakura city, on the roof-floor (15m. above the ground) of the city hall ; Chiba city, on the terrace (3m. above the ground) of Takagi's pharmacy and Kisarazu city, on the roof-floor (20m. above the ground) of Kimitsu Chuō Hospital. The slide coated with vaseline was replaced usually every two days (48 hours) during the period of the pollination of *Cryptomeria japonica* from 1978 to 1980.

In the meantime, the end of February in 1979 and the end of March in 1980, the authors observed the hourly variations of the dispersal pollen grains of *Cryptomeria japonica* during 24 hours, at Funabashi city, on the campus (on a stand 1m. above the ground) of Toho University.

The method of preparation of the slide was followed the authors' previous papers⁵⁾⁶⁾.

Results and Discussion

Fig. 2 shows the fluctuations in three years of *Cryptomeria japonica* pollen grains collected on a slide of 10 cm² per two days at Funabashi city (Funabashi) from 1978 to 1980. The number of the pollen grains at the maximum peak (the largest in number per two days) was 556 in 1978, 2460 in 1979 and 452 in 1980. The maximum peak appeared from 25th to 26th March, from 23rd to 24th February and from 18th to 19th March in 1978, 1979, and 1980 respectively.

Fig. 3 shows the fluctuations in three years of *Cryptomeria japonica* pollen grains collected at Sakura City (Sakura) from 1978 to 1980. The number of the maximum peak was 1902 in 1978, presumably 9718 in 1979 and 3000 in 1980. The date of the maximum peak was from 17th to 18th March in 1978, presumably from 21st to 22nd February in 1979 and from 10th to 11th March in 1980. At Sakura in 1979, the authors could not collect the dispersal pollen grains at the middle of February, when the maximum peak might be observed.



Fig. 1. Location of the airborne pollen sampling areas in Chiba Prefecture (1978—1980).

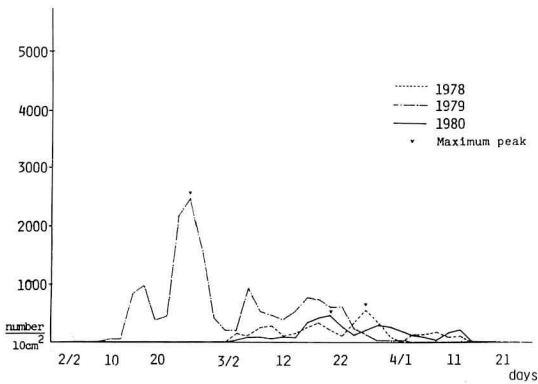


Fig. 2. The fluctuations in three years (1978—1980) of the pollen grains of *Cryptomeria japonica* at Funabashi city (10 cm², 48 hours)

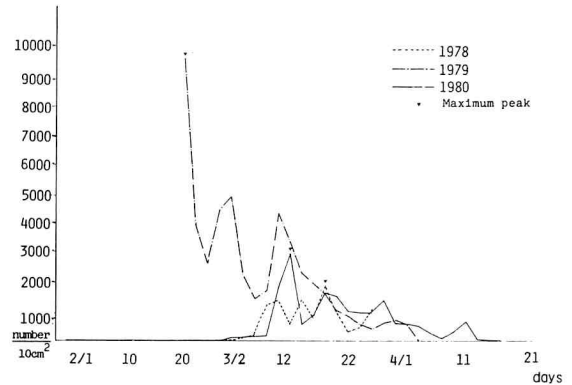


Fig. 3. The fluctuations in three years (1978—1980) of the pollen grains of *Cryptomeria japonica* at Sakura city. (10 cm², 48 hours)

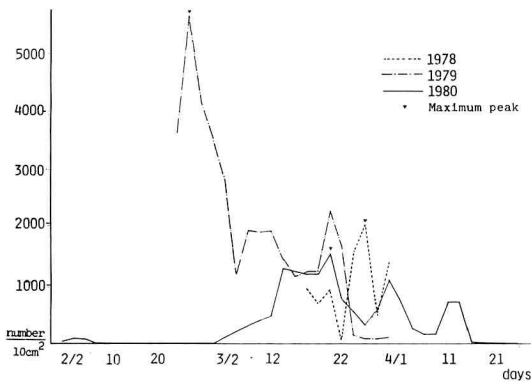


Fig. 4. The fluctuations in three years (1978—1980) of the pollen grains of *Cryptomeria japonica* at Chiba city. (10 cm², 48 hours)

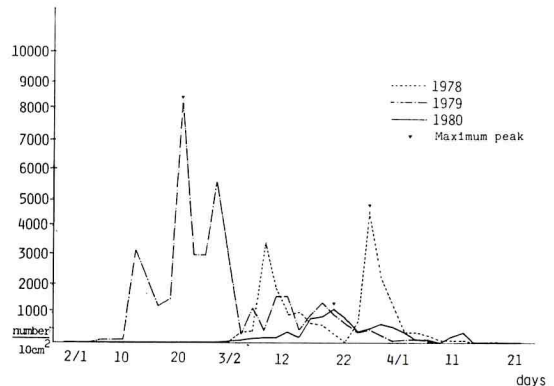


Fig. 5. The fluctuations in three year (1978—1980) of the pollen grains of *Cryptomeria japonica* at Kisarazu city. (10 cm², 48 hours)

Fig. 4 shows the fluctuations in three years of *Cryptomeria japonica* pollen grains collected at Chiba city (Chiba) from 1978 to 1980. The number of the maximum peak was 2048, 5672, and 1555 in 1978, 1979, and 1980 respectively. The date of the maximum peak was from 25th to 26th March, from 23rd to 24th February, and from 18th to 19th March in 1978, 1979, and 1980 respectively. The observation in 1978 was conducted only in the period of the full pollination of *Cryptomeria japonica*, so that the total number of *Cryptomeria japonica* pollen grains throughout the pollination time could not be obtained in 1978.

Fig. 5 shows the fluctuations in three years of *Cryptomeria japonica* pollen grains collected at Kisarazu city (Kisarazu) from 1978 to 1980. The number of the maximum peak was 4500 in 1978, 8200 in 1979 and 1195 in 1980. The date of the maximum peak was from 25th to 26th March, from 21st to 22nd February and from 18th to 19th March in 1978, 1979, and 1980 respectively.

While the hourly variations of the dispersal pollen grains of *Cryptomeria japonica* during 24 hours in 1979 is shown in Fig. 6. From both results of the gravity and volumetric methods, the maximum peaks were overlapped each other at the time of the lowest humidity, though the number obtained by the volumetric method was greater about three times than that by the gravity one. The hourly variation of the pollen grains in 1980 is shown in Fig. 7. By the gravity method, the maximum peak appeared at the time of the lowest humidity, at about 5 p.m., but by the volumetric method, the maximum peak was observed at the time of the highest humidity, at about midnight. Though the total number of the grains during 24 hours in 1980 was only one-tenth of the one in 1979 (Fig. 6).

The three years' results in the present study, the monthly average temperature and the monthly amount of rainfall from February to April in each year (1978–1980) are shown in Fig. 8. The maximum peak per two days is shown as a square on the solid line which shows a period of the pollination of *Cryptomeria japonica*, but the line represents only the period, when the pollen grains were observed over 100 grains in each per two days. While a part of dotted line shows the uninvestigated period, regarding as an extension line of the solid one, from the results of investigated periods in other areas.

The dispersal pollen grains of *Cryptomeria japonica* were collected for the first time early in February in 1979, while both in 1978 and 1980, at the beginning of March, the latter was a little earlier than the former. The maximum peak appeared at late in February in 1979, at the middle of March in 1980 (except Sakura) and at late in March in 1978 (except Sakura). The maximum peak at Sakura, it was observed one week earlier than other areas both in 1978 and 1980. The maximum peaks which were the largest in numbers during three years were observed at every area in 1979, even the smallest in number (2460) at Funabashi

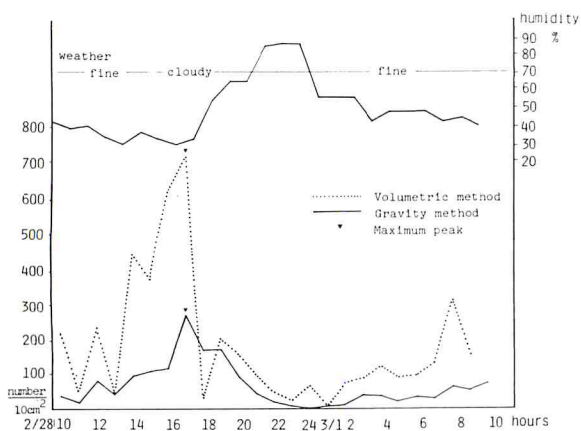


Fig. 6. Hourly variations of the dispersal pollen grains of *Cryptomeria japonica* during 24 hours at Funabashi city (1m. above the ground) in 1979. (gravity method, 10 cm², 1 hour ; volumetric method, 7 l/min.)

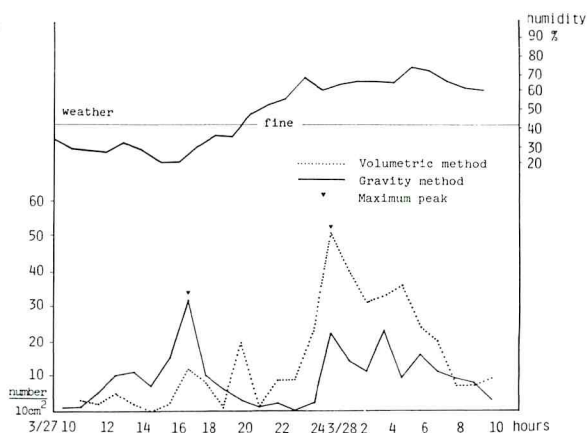


Fig. 7. Hourly variations of the dispersal pollen grains of *Cryptomeria japonica* during 24 hours at Funabashi city (1m. above the ground) in 1980. (gravity method, 10 cm², 1 hour ; volumetric method, 7 l/min.)

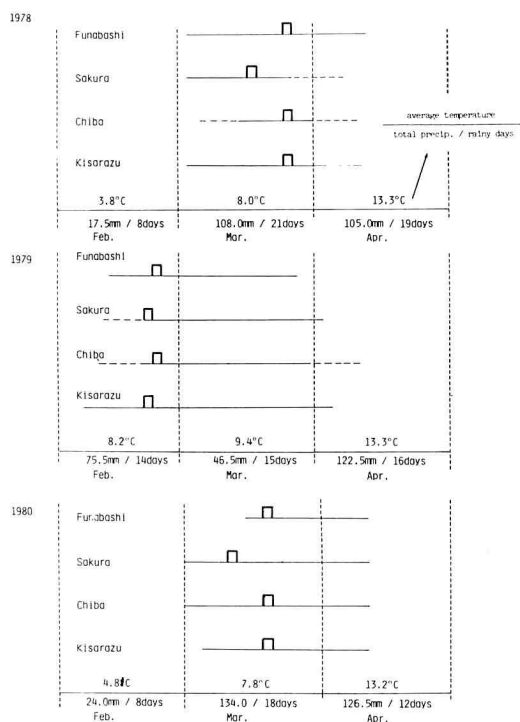


Fig. 8. The fluctuations in three years (1978—1980) of the pollen grains of *Cryptomeria japonica* at four urbanized areas.

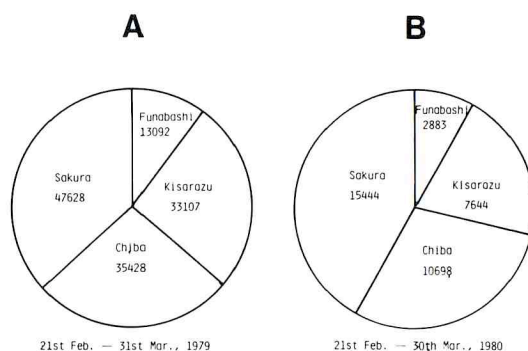


Fig. 9. Total numbers of the dispersal pollen grains of *Cryptomeria japonica* during its pollination period in 1979 (A) and 1980 (B) at four urbanized areas.

was about four times larger than those of both in 1978 and 1980. The number of the maximum peak was 9718 grains at Sakura in 1979, but if the authors had observed the dispersal pollen grains at the middle of February, they could have obtained over 10000 grains per two days.

The total numbers of *Cryptomeria japonica* pollen grains in the period of the pollination from 21st February to 31st March at each area in 1979 is shown comparatively in Fig. 9-A. The total number at Funabashi (13092) was about 10%, i.e. the smallest value, while Sakura's one (47628) was about 37%, i.e. the largest value, and both the total numbers of Chiba (35428) and Kisarazu (33107) were similar values, the former is 27% and the latter 26%. While in 1980, the result is shown in Fig. 9-B. The total number of Funabashi decreased 2883 corresponding to about 22% of the previous year, and Sakura's one (15444) was also decreased to about 32% of the previous year. Furthermore, the total numbers in 1978 at each area are almost equal to the numbers of 1980, but slightly larger than the latter. From these results, the total numbers in three years are extremely different between Funabashi (ca. 10%) and Sakura (ca. 40%), while both Chiba (ca. 25%) and Kisarazu (ca. 25%) are almost the same. From the above-mentioned result, each situation of four urbanized areas certainly have a great influence on the total numbers during the pollination period of *Cryptomeria japonica* pollen grains. Namely, Sakura is located at slightly elevated Shimosa

Plateau, fairly progressed in urbanization and the large planting areas of *Cryptomeria japonica* are remained in its outskirts. So that the large source of the airborne pollen grains of *Cryptomeria japonica* is quite near. On the contrary, Funabashi is located at low land and progressed in urbanization even its outskirts, namely the planting areas of *Cryptomeria japonica* are considerably small, and so the source of the airborne pollen grains is quite few. While Chiba and Kisarazu are in very similar situation, namely, both of them locate on a little eminence where the planting areas of *Cryptomeria japonica* are fairly remained. Accordingly, Chiba and Kisarazu are in intermediate circumstances between Funabashi and Sakura.

What has caused the unexpectedly result of large number in 1979? The cause was supposed to be the unusual high temperature of atmosphere. Namely, the monthly average temperature (8.2°C) of February in 1979 was higher 3.1°C than the normal one (5.1°C), and also one of March (9.4°C) was higher 1.6°C than the normal one (7.8°C). From the reason of these unexpectedly higher temperatures, the start of the dispersal pollen grains of *Cryptomeria japonica* was about one month earlier than those of 1978 and 1980. Furthermore, the total amount of rainfall in March 1979 (Fig. 9) registered 46.5 mm., that was a half or one third of those of 1978 and 1980. Surely the number of the dispersal pollen grains in March of 1979 showed the largest.

It is reliably reported⁷⁾ that the close relationship existed between the monthly average temperature of July in the present year and the total number of the airborne pollen grains of *Cryptomeria japonica* in the next year's season.

These results indicate that the large total number of the airborne pollen grains of *Cryptomeria japonica* can be obtained under the some unusual weather conditions, such as the higher average temperature in February as seen in 1979, or the small amount of rainfall during the pollination period as seen in March of 1979 and presumably the higher average temperature of July in the previous year. While the vegetation of *Cryptomeria japonica* in each pollen sampling area and the total number of the pollen grains during the pollination period was in close relationship to each other. Namely, Funabashi has only small planting areas of *Cryptomeria japonica* even in its outskirts, and had small total in number of the pollen grains among three years, except in 1979 (but smallest in number than those of other areas). On the contrary, Sakura has large planting areas of *Cryptomeria japonica* in its outskirts, and had large total number of the pollen grains, especially in 1979.

It is concluded that these results can be used to consider the relationship between the number of *Cryptomeria japonica* pollen grains and the total number of the patients of pollinosis through the period of the pollination.

Aknowledgement

The authors are sincerely grateful for many helpful supports to collect the airborne pollen grains from the following : Messers. K. Kushida and H. Takaishi of Sakura city hall, Sakura city ; Messers. S. Iizuka and K. Ohtake of Kimitsu Chuō Hospital, Kisarazu city and Mr. M. Takagi of Takagi's pharmacy, Chiba city.

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要 約

花粉形態として外極面のほぼ中央が突出し、しかもその先端がカギ状に一方方向に曲がり花粉内部に屈折率の高い物質を含有したスギ花粉は、他の浮遊花粉から区別しやすい。この特徴ある形態をもととして1978年～1980年の3年間、スギ花粉の飛散シーズンに千葉県都市化の進んでいる4地点〔船橋市（前報までは習志野市として報告）、佐倉市、千葉市、木更津市〕を対称として落下法により、2日間（48時間）毎にスライドを交換し、10 cm² 内の花粉数を比較調査した。また1979年2月下旬と1980年3月下旬に24時間内1時間毎のスギ花粉の調査も行ない次の結果を得た。

- 1) 2月の平均気温が平年より3℃以上も高かった1979年では最大捕集日が2月下旬に、47,628個認められた。また平年より1℃低かった1978年では3月下旬に、そしてほぼ平年並であった1980年で

は3月中旬に認められた。したがってこの結果から2月の平均気温の変化が、その年の最大捕集日の出現に強く影響を与えることは、ほぼ確実と考えられる。特にこのことは最近問題視されつつあるスギ花粉症と大いに関連のあることを知った。

- 2) 3年間のスギ花粉飛散シーズン中の総捕集における調査地点間の相対的な関係は、佐倉>千葉≧木更津>船橋の順であった。その理由として4調査地点周囲の花粉源となるスギの人工林の多少〔佐倉>千葉≧木更津>船橋〕も捕集数に影響を与える大きな要素と考えられる。

- 3) スギ花粉のほぼ最大飛散時期における24時間内1時間毎の調査結果は、1979年においては、最大捕集数と湿度との間に相関関係が認められた。しかし1980年においては捕集数が少なかったためこの関係は明確なものとならなかった。

これらの結果とスギ花粉症との間に実際どのような関連があるかを引き続き研究中である。

☆ 会員の訃報・阪本祐二会員

朝日新聞昭和 54 年 12 月 30 日によるとハス研究家、和歌山県立日高（ヒタカ）高校教諭阪本祐二氏は 12 月 29 日午前 4 時 40 分、急性心不全のため死去された。54 歳。氏は東京農林専門学校（現東京農工大学）時代からハス博士・故大賀一郎氏に師事。昭和 54 年 4 月、大賀博士の大賀ハスと中国古代ハスとの交配種「中日友誼蓮ユウギレン」の種子を開花させ、中国へ里帰りさせた。

氏は篤学の人で、交配の研究から花粉に興味を持ち、上野の花粉学研究（1978）を調べて、古い系統では 4 集粒花粉が多いことから大賀ハスや中国古代蓮の 4 集粒花粉出現率が 15～13%であるが、交配種の中日友誼蓮では 0%であることをつきとめた。氏は昭和 54 年 11 月 11 日の第 20 回日本花粉学大会でその報告をされ、更に研究を進める予定であった。謹んで阪本会員の冥福を祈りたい。

阪本氏の死後、日本花粉学会会誌 24 号の記事をみた毎日新聞御坊通信部星出敏男氏から 3 回にわたって、長い電話が上野にかかってきた。それは故阪本氏の研究成果、とくに 20 余年にわたり栽培し研究していた大賀ハスが果して、大賀博士の説の如く、2000 年前の古い形質の存在が科学的に証明できたのかという質問であった。上野は故阪本氏が生前、第 20 回日本花粉学会大会で発表されたデータの花粉学的な根拠と価値を説明した。そして 3 カ月たって、毎日新聞としても検討した結果、昭和 55 年 4 月 12 日の毎日新聞の全国版に、大賀博士・阪本氏、大賀ハスの 4 集粒写真とともに 5 段の記事として、「大賀ハスはやはり古代ハス」として広く紹介された。故阪本氏もさぞ満足されたことであろう。学会として会員の研究成果を正式に学会誌に印刷してあったことが幸であった。今後も会員の研究データを大切に保存・記録しておきたい（上野）。