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Author(s)	Igarashi, Yaeko
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POLLEN INCIDENCE AND WIND TRANSPORT IN CENTRAL HOKKAIDO (I)

by

Yaeko Igarashi

(with 8 text-figures and 1 table)

(Contribution from the Department of Geology and Mineralogy,
Faculty of Science, Hokkaido University, No. 1640)

Abstract

Four pollen traps at different levels were used in a natural broad-leaved forest near Tomakomai, central Hokkaido, to investigate pollen incidence and wind transport. The trap at trunk level captured a lesser amount of pollen than the other traps. The pollen period of the canopy trees was from March to the middle of June and it was characterized by a gradual increase in amount of pollen but a sharp decrease. Among the canopy trees, *Carpinus*, *Quercus*, *Alnus*, *Betula* and *Cryptomeria* showed the highest pollen frequency. Pollen transported into the sampling site were those of *Cryptomeria*, *Fagus*, *Aesculus*, *Castanea* and *Tsuga*. Although *Cryptomeria* pollen accounted for 38–48% of the total amount of the canopy tree pollen in the middle of April 1978, the nearest *Cryptomeria*-bearing forest is about 16 km west of the sampling site.

Introduction and acknowledgements

In order to investigate the relation between the pollen rain and the surrounding vegetation, four pollen traps were used in a natural forest during two consecutive years, 1977–1978.

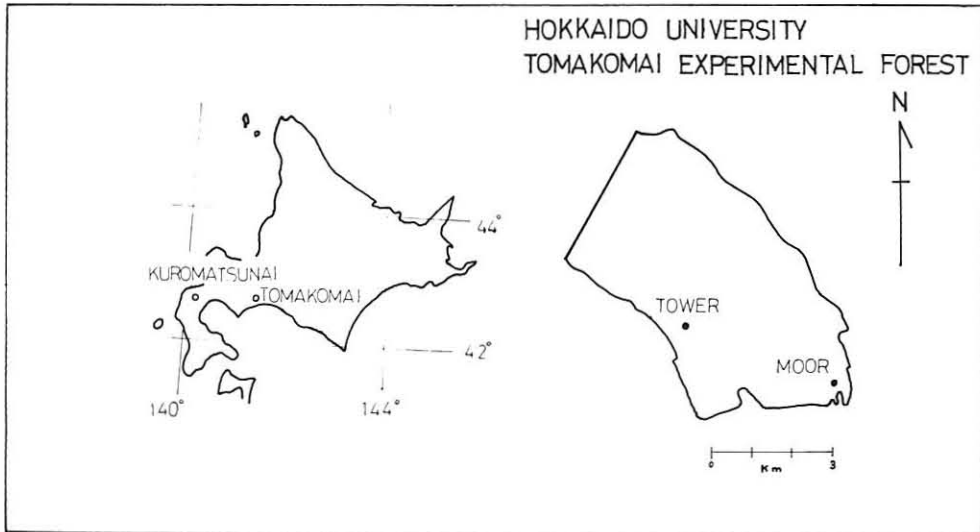
The author especially acknowledges the supervision and encouragement of Prof. Masao Minato of Hokkaido University during the course of this study. Her thanks also go to Dr. Kenkichi Ishigaki, head of Hokkaido University Tomakomai experimental forest and his colleagues for their help in changing traps. Finally she wishes to thank Dr. Tsuneo Igarashi, Hokkaido University experimental forests, for his kindness in providing information about the vegetation.

Collection sites and methods

The traps were placed in the Hokkaido University Tomakomai experimental forest, which occurs on low hills near the Pacific Ocean (text-figure 1). It is a natural deciduous broad-leaved forest of 2700 ha. composed mainly of *Quercus*, *Fraxinus*, *Alnus*, *Carpinus* and *Betula* (Kudo et al, 1916). However, one-third of this forest is a reforested area of *Larix*, *Abies*, *Pinus* and *Picea*.

Pollen and spores were collected using the sedimentation method. The traps were unroofed stainless cylinders 16 cm long by 16 cm in diameter, modified from the Tauber trap (Tauber, 1967). Inside the cylinders were coated with glycerine jelly.

Three traps were placed on the southern balcony of a 31 m high tower, near the western edge of this forest. The tower was built to observe the vegetation, animals and weather in the



Text-figure 1 Location of collection sites and northern limit of *Fagus* habitat.

forest. One of three traps was placed above the canopy at 24 m above ground level, one was placed at 17 m, the same level as the canopy, and a third at 10 m at trunk level. A fourth trap was placed on a stand 0.2 m above the ground. In 1977, the fourth trap was placed under the open canopy about 200 m south of the tower, it was moved to a moor about 3.5 km southeast of the tower in 1978.

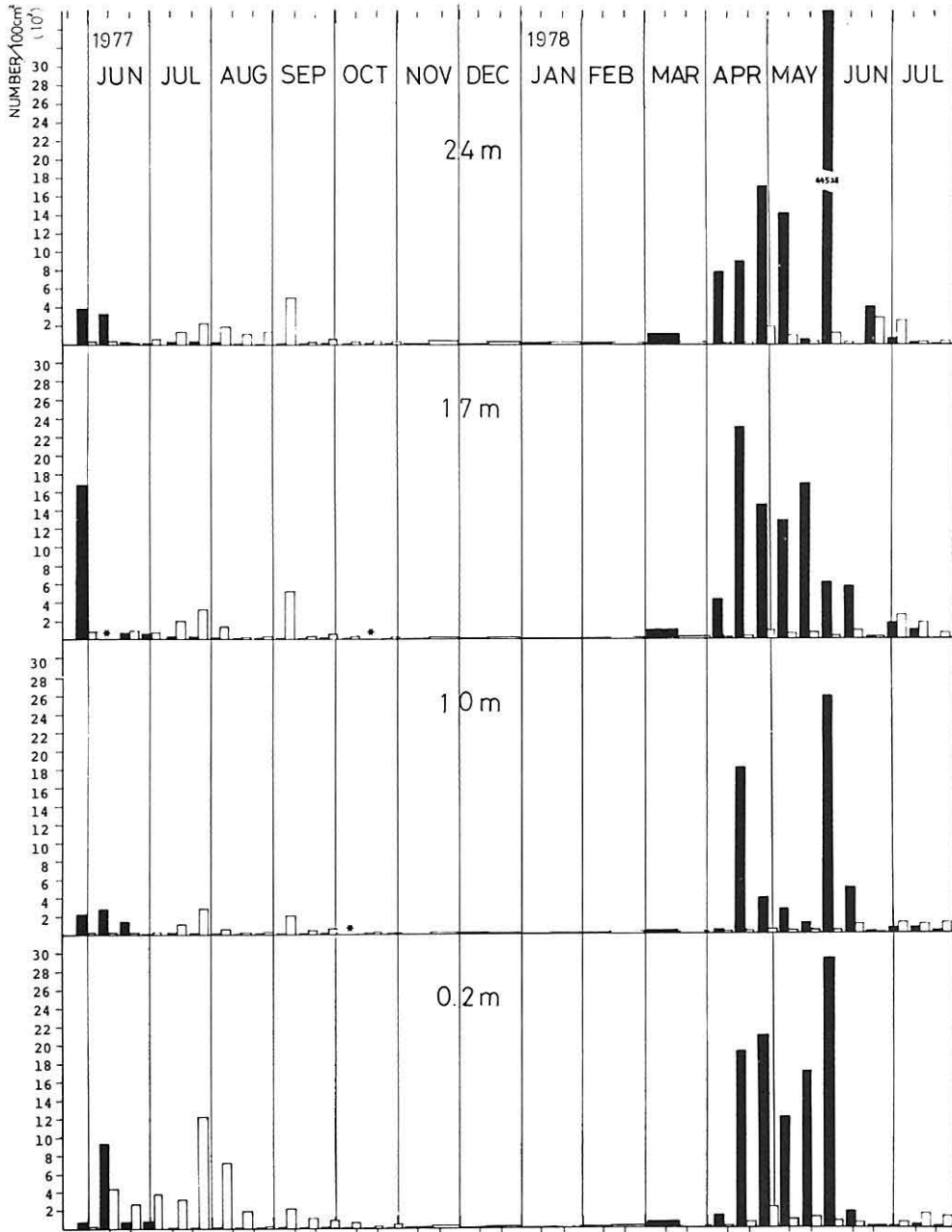
Collections were made at intervals from 27 May 1977 until 6 July 1978. The traps were changed every 10 days from March to October and every 30 days from November to February.

Result

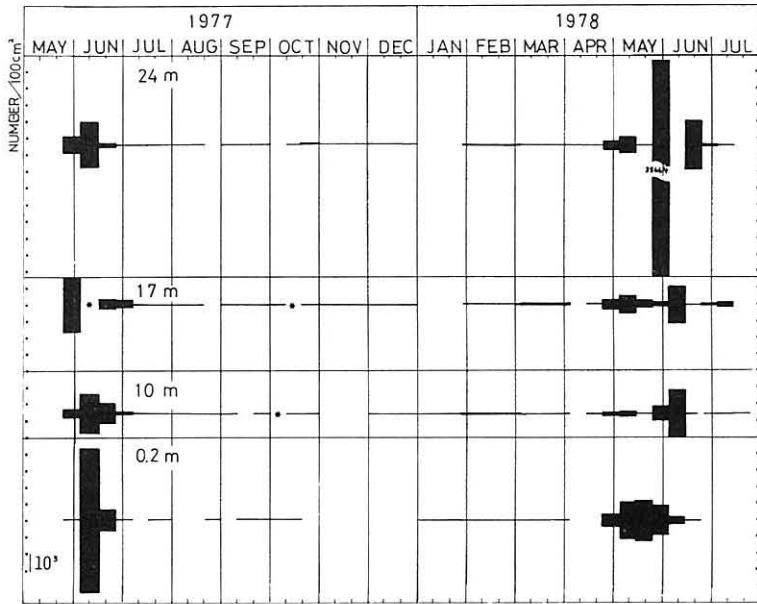
The total amount of pollen from the canopy trees and the undergrowth per 100 cm² for each of the sampling periods is shown graphically in text-figure 2.

The canopy tree pollen in the traps were: *Pinus*, *Larix*, *Picea*, *Abies*, *Cryptomeria*, Cupressaceae, *Tsuga*, *Taxus*, *Quercus*, *Betula*, *Alnus*, *Ulmus*, *Corylus*, *Salix*, *Fraxinus*, *Cornus*, *Tilia*, *Juglans*, *Acer*, *Ostrya*, *Populus*, *Castanea*, *Magnolia*, *Morus*, *Fagus*, *Carpinus*, *Sorbus*, *Phellodendron*, *Prunus*, *Aesculus*, *Kalopanax* and *Cercidiphyllum*. All of these trees are now growing in this forest except *Cryptomeria*, *Fagus*, *Aesculus* and *Castanea*. Among these trees, pollen of *Quercus*, *Betula*, *Alnus*, *Carpinus* and *Cryptomeria* showed the highest frequency (text-figures 3, 4, 5, 6, 7).

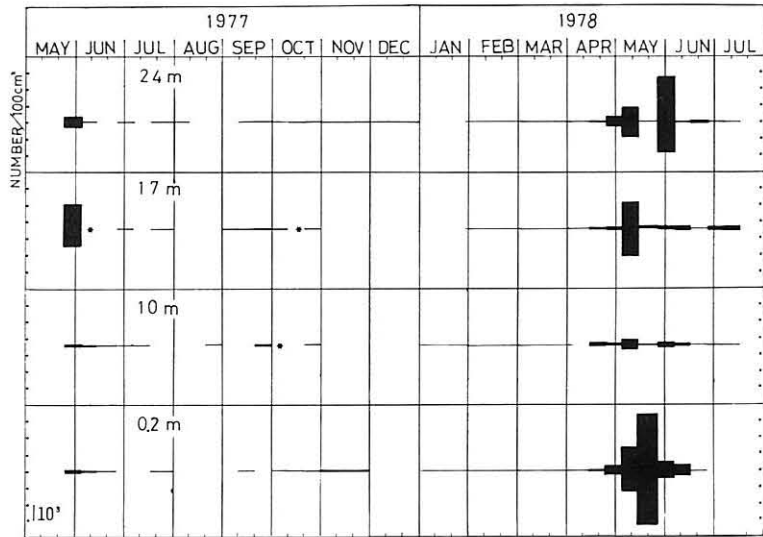
Pollen and spores from the undergrowth were: *Euonymus*, *Elaeagnus*, *Rhamnus*, *Hydrangea*, *Ligustrum*, *Picrasma*, *Sorbaria*, *Rhus*, *Leguminosae*, *Rosaceae*, *Spiraea*, *Sanguisorba*, *Potamogeton*, *Geum*, *Rumex*, *Carex*, other Cyperaceae, Liliaceae, Gramineae, *Urtica*, *Lysimachia*, *Chenopodium*, *Polygonum*, *Campanula*, *Persicaria*, *Artemisia*, other



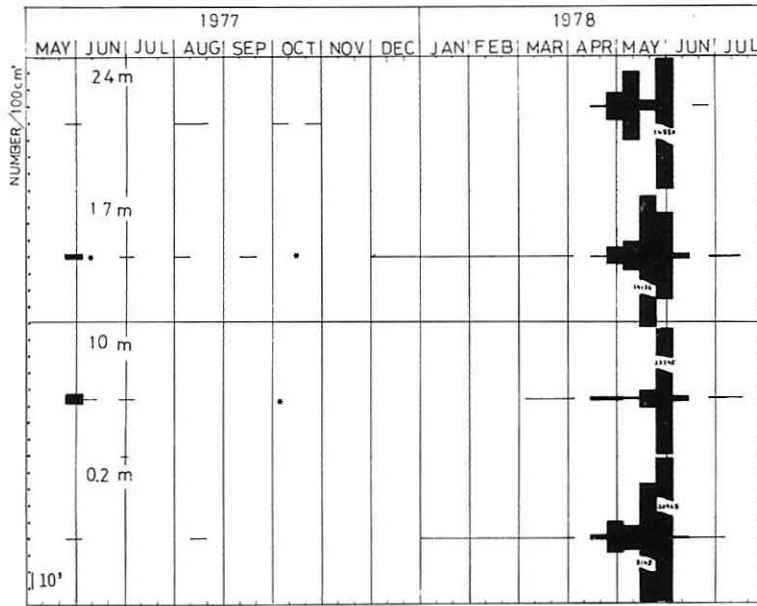
Text-figure 2 Pollen totals for the canopy trees (shaded columns) and the undergrowth (white columns) every 10 days at different levels. (* samples were lost in analytical process)



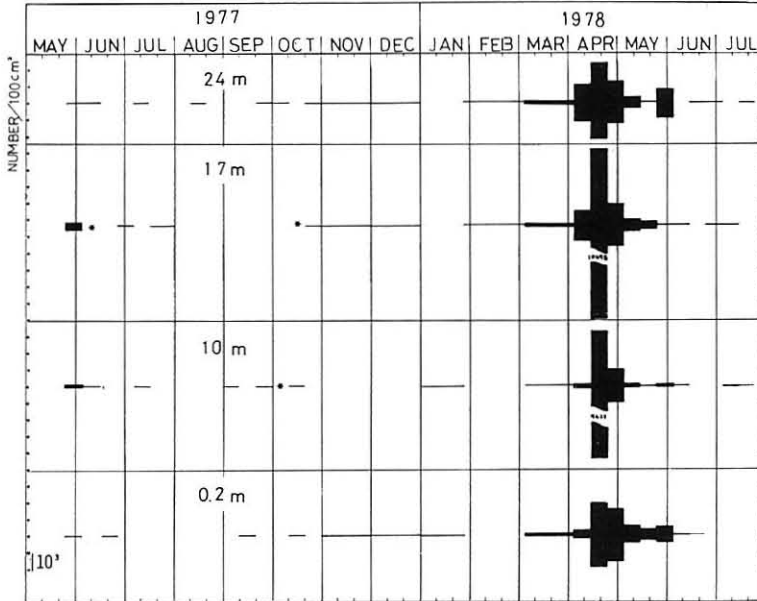
Text-figure 3 Pollen incidence of *Quercus* at four different levels every ten days. (* samples were lost in analytical process)



Text-figure 4 Pollen incidence of *Betula* at four different levels every ten days. (* samples were lost in analytical process)



Text-figure 5 Pollen incidence of *Carpinus* at four different levels every ten days. (* samples were lost in analytical process)



Text-figure 6 Pollen incidence of *Alnus* at four different levels every ten days. (* samples were lost in analytical process)

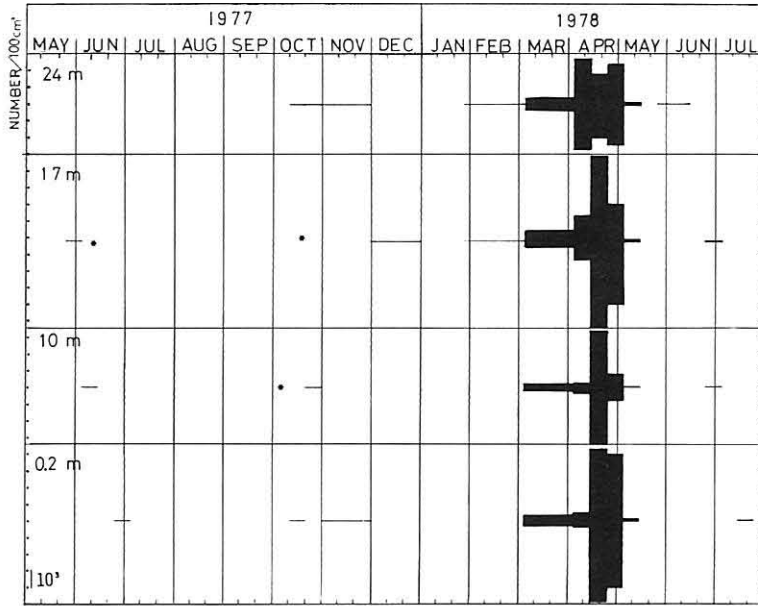
Table 1 Number of pollen and spores per 100 cm² for the period from November to February at different levels

	24m	17m	10m	0.2m
<i>Picea</i>	29	9	13	5
<i>Cryptomeria</i>	11	10		6
Cupressaceae			20	7
<i>Pinus</i>	39	21	32	16
<i>Abies</i>	9		5	
<i>Betula</i>	49	6	11	80
<i>Alnus</i>	31	8	7	20
<i>Acer</i>				4
<i>Carpinus</i>	4	2		4
<i>Quercus</i>	144	34	94	18
<i>Juglans</i>	3			5
<i>Fagus</i>	6			6
<i>Kalopanax</i>			4	8
<i>Tilia</i>	3	3	4	
<i>Sorbus</i>			2	
<i>Ulmus</i>	11	2	5	3
<i>Corylus</i>		2		
<i>Phellodendron</i>			4	
<i>Elaeagnus</i>		4		
<i>Euonymus</i>	3			3
Caryophyllaceae				2
<i>Artemisia</i>	80			
<i>Epilobium</i>				
Compositae	8	4		
<i>Chenopodium</i>	5	11		
<i>Sanguisorba</i>				
<i>Polygonum</i>				
<i>Caltha</i>				
<i>Aralia</i>	9	3		
<i>Reynoutria</i>			5	
<i>Rumex</i>		2		
<i>Plantago</i>		4		
Gramineae	73	51		22
<i>Hydrangea</i>	7			
<i>Typha</i>	6			
Cyperaceae	3			
<i>Rhus</i>		4		
<i>Lycopodium</i>	10	192		84
Polypodiaceae	92	70		63
<i>Osmunda</i>		9		4
Others	38	78		21
Total	673	569		423

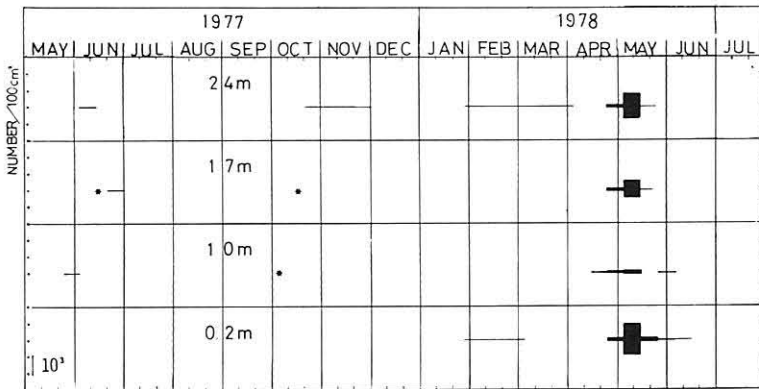
Compositae, *Plantago*, *Celastrus*, *Capsella*, *Potentilla*, *Angelica*, Caryophyllaceae, *Aralia*, Ranunculaceae, *Epilobium*, *Tiarella*, *Cardamine*, *Pyrola*, *Chloranthus*, *Oenanthe*, *Osmunda*, Polypodiaceae, *Lycopodium*, *Equisetum* and *Sphagnum*. These are all growing in the forest at the present time.

Discussion

The pollen period of the canopy trees occurred from March and continued about 90 days until June. It was characterized by a gradual increase in amount of pollen and a sharp decrease. The undergrowth had a longer pollen period than the canopy trees, lasting from



Text-figure 7 Pollen incidence of *Cryptomeria* at four different levels every ten days. (* samples were lost in analytical process)



Text-figure 8 Pollen incidence of *Fagus* at four different levels every ten days. (* samples were lost in analytical process)

the end of April until October (text-figure 2), but the amount of pollen of the undergrowth was much less than that of the canopy trees, both in the open canopy and in the moor. The amount of pollen at different level did not show any remarkable differences, but the trap at 10 m showed slightly smaller amount of pollen than the other traps. It seems probable that filtration by the vegetation may limit the amount of pollen in the trunk space. The trap at

0.2 m, both in the open canopy and in the moor, was not influenced by filtration. The main pollen period of each canopy tree lasted 40 to 50 days. Although pollen incidence occurred mainly at flowering time, there were a significant amount of pollen and spores present in wintertime (table 1).

Pollen transported from a distance included *Cryptomeria*, *Fagus* (text-figure 8), *Aesculus*, *Castanea* and *Tsuga* pollen. Especially large amounts of *Cryptomeria* pollen occurred from March to the beginning of May. *Cryptomeria* pollen accounted for about 48% of the total canopy tree pollen in the middle of April in the 17 m trap. Although *Cryptomeria* is not native to Hokkaido, there are now many reforested *Cryptomeria* forests, especially in southwest Hokkaido. The *Cryptomeria*-bearing forest nearest to the pollen traps is about 16 km west of Tomakomai. *Fagus* pollen also showed a substantial frequency. It peaked in the middle of May at which time it accounted for about 14% of the total canopy tree pollen. The northern limit of *Fagus* is in the Kuromatsunai lowland about 100 km west of Tomakomai.

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- Kudo, Y. and Yoshimi, T., 1916. Flora of the Hokkaido University Tomakomai experimental forest. *Research Bulletins of the College Experiment Forests Hokkaido University*, 1(4): 1-63.
- Tauber, H., 1967. Investigations of the mode of pollen transfer in forested areas. *Review of Palaeobotany and Palynology*, 3: 277-286.

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