AEROPALYNOLOGICAL STUDY OF NANKANG, TAIPEI (TAIWAN)[1]

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Abstract: An investigation on airborne pollen during 1983 at Nankang, Taipei was undertaken. Pollen grains and fern spores encountered within an area of 3.24 cm² on a trap slide were counted and identified to genus level. The results show that the highest concentration of airborne pollen grains was found in the spring with a number of tree pollen: *Pinus, Juniperus-Cunninghamia, Myrica, Broussonetia, Celtis, Ligustrum, Bischofia, Podocarpus, Casuarina, Trema, Acacia confusa* and *Mallotus japonicus. Salix* and *Morus* flower at the end of the winter or at the beginning of the spring. In the summer, many fern spores, namely *Alsophila, Dicranopteris, Pteridium, Nephrolepis* and *Lepisorus* and some weeds pollen, like Chenopodiaceae were recorded, while in the autumn *Mallotus paniculatus, Alnus, Melaleuca* and Gramineae were of dominant species. Some weed pollen of *Artemisia, Ambrosia* and *Humulus* were also found in the autumn. In the winter the dominant pollen species were Gramineae. A pollon calendar showing the occurring pollen and fern spore species during a year is demonstrated.

INTRODUCTION

Nankang is situated in the eastern suburban of Taipei, ca 10 Km away from he previous sampling station, campus of National Taiwan University (Chen & Huang, 1980) which is located in the southern part of Taipei City. The pollen and ern spores are abundant due to the plants on the face of the hillsides that ircumscribe Nankang. The present paper aims to study the airborne pollen and ern spores and offers a complete pollen calendar for Nankang area. It can serve need with special reference to allergology.

MATERIALS AND METHODS

Atmospheric pollen grains and fern spores were trapped as described previously Chen & Huang, 1980). The trap was exposed 24 hrs a day on the roof, about 20m bove the ground level, of the Botanical Institute, Academia Sinica, Nankang, Taipei throughout the year of 1983. Two slides coated with gelatin jelly (Wodeouse, 1971) were vertically placed in the trap. After removing the slides from he trap a droplet of Entellan was dropped onto the slides. The sample was hen covered with a cover glass in dimension of 3.24 cm². The species of pollen rains and spores encountered within the covered area were identified under nicroscope. The frequencies of presence of each pollen and spore species were ecorded.

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RESULTS

The daily abundance of the common airborne pollen and fern spores is illustrated in Fig. 1. The characteristics of the common airborne pollen and spores were described as following:

Tree pollen:

Salix: Due to the rainy season in the winter the beginning of the pollen season is difficult to determine. The common species in Taipei are *S. babylonica* and *S. warburgii*. Both species can be observed in the trapped samples.

Juniperus-Cunninghamia: Pollen of these two genera appear nearly in the same period. Due to the similar pollen morphology, both taxa are listed together. The pollen grains are found between the end of January and the beginning of April with a peak by 105 grains per 3.24 cm^2 on 1st March. Both plants are plantd in the city and suburban as ornamental plants.

Morus: The pollen season begins at the end of January. The existence of this pollen in the atmosphere can be detected until the beginning of March, although they are only in samll quantity throughout the pollen season.

Piuus: Pollen grains are very abundant in March with a maximum of 793 grains per 3.24 cm^2 on 1st March, some appear in April.

Myrica: The pollen season is from the beginning of March to the beginning of April with a maximum of 60 grains per 3.24 cm^2 on 19th March.

Celtis: Pollen grains are found in low percentage in the period from the middle of March to the beginning of April.

Ligustrum: Pollen grains appear from the middle of March to the middle of April. Maximal value is 79 grains per 3.24 cm^2 on 19th March.

Broussonetia: The main pollen season is in March and April. Morphologically this pollen is difficult to distingish from that of *Boehmeria*.

Bischofia: Pollen grains are present in March and April in low concentration.

Podocarpus: The main pollen season is in April and May with a maximum of 495 grains per 3.24 cm^2 on 27th April.

Picea, *Abies* and *Tsuga*: Only a few pollen grains of these taxa are recorded. The presence of these pollen grains in this area is probably resulted from the long distance transport of pollen, because these plants are not found in Taipei. The pollen grains of these taxa are found between March and May.

Casuarina: Only a samll amount of pollen is collected throughout the pollen season which is from April to November.

Trema: The pollen season is relatively long, namely from April to September. Quantitatively, a greater part of this pollen is trapped in the spring and is ascribed to be *T. orientalis*. In the summer, pollen should be of *T. canabina*.

Acacia: The pollen season begins in April and ends in September with low pollen concentration throughout the season. They are ascribed to be *A. confusa*. It is not an anemophilous plant.

Alnus: Pollen grains are present from September to December and are ascribed to be *A. henryi*. Maximal value is 246 grains per 3.24 cm^2 on 5th October.

Mallotus: Several species are found. Those pollen present in April and May are ascribed to be *M. japonicus*, and those in September and October to be *M. paniculatus*.

Melaleuca: Pollen grains are present from the end of August to the beginning of November and are morphologically diffiucIt to distinguish from that of *Eucalyptus*.

Grasses pollen:

Gramineae: Grasses pollen can be trapped in all the seasons. The greatest part of grasses pollen is found in the period between the beginning of November and the beginning of December, in which *Miscanthus* occupies the largest amount because this plant is widely distributed in the neighboring area.

Weed pollen:

Cyperaceae: The pollen season is either in the spring or at the beginning of the autumn. The pollen counts are low.

Sedum: Pollen grains are found from the end of April to the middle May with a maximum of 62 grains per 3.24 cm^2 on 25th April.

Lysimachia: Pollen grains are found in April and May. They are ascribed to be *L. ardisioides* and *L. formosana*.

Plantago: The pollen season is relatively long namely from the spring to the autumn with low quantity.

Chenopodium: Pollen grains appear from the end of May to October with low quantity.

Artemisia: Pollen grains are found from September to November with low quantity. Maximal value is 23 grains per 3.24 cm^2 on 2nd September.

Ambrosia: Pollen grains appear from the end of August to the beginning of October with a peak of 109 grains per 3.24 cm^2 on 15th September.

Humulus: Pollen grains are found in September and October with a peak on 5th October by 32 grains per 3.24 cm^2

Fern spores:

Alsophila: Spores are found throughout the year. The greatest part appears from July to September with maximal count of 1695 grains per 3.24 cm^2 on 25th July.

Table 1. Some rare airborne pollen and fern spores.
"+" indicates the occurring period of pollen and spores

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Tree pollen:												
Aphanathe			+									
Breynia				+								
Bridelia tomentosa				+								
Buchanania arborescens				+								
Camellia				+								
Castanopsis			+	+								
Cocculus					+							
Cycas						+						
Cyclobalanopsis glauca			+	+	+	+						
Elaeagnus				+								
Elaeocarpus				+	+	+	+	+	+			
Engelhardtia				+					+			
Fagus					+							
Hydrangea chinensis				+								
Ilex				+								
Kadsura				+								
Keteelaria				+								
Lagerstroemia							+					
Lauraceae									+			
Liquidambar			+									
Macaranga tanarius				+								
Malvaceae			+									
Michelia			+									
Myrtaceae				+	+	+						
Pachycentria formosana												+
Phoenix						+	+					
Pipturus				+								
Pistacia chinensis			+									
Pittosporum				+								
Punica						+						
Rhododendron			+									
Rosa				+								
Rhus				+								
Sapium					+							
Weed pollen:												
Ardisia				+	+							
Campanulaceae			+									
Caryophyllaceae			+									

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Compositae				+			+					
Cruciferae				+				+	+		+	
Drymaria											+	
Epilobium			+									
Gentianaceae							+	+	+			
Labiatae					+							
Narcissus			+									
Polygonum						+						
Randia spinosa		+	+									
Rumex				+	+							
Solanum					+							
Stauntoria				+								
Fern spores:												
Aspidiaceae							+		+	+		
Athyrium	+			+					+			
Christella									+			
Colysis									+			
Cypsinus	+											
Dennstaedtia scandens			+		+				+	+		
Diplazium							+	+	+	+		
Diplopterygium								+				
Lemmaphyllum							+					
Lycopodium							+		+	+	+	
Lygodium										+		
Polypodium							+					
Thelypteridaceae							+	+				

Dicranopteris: Like *Alsophila*, the spores are found throughout the year and majorly present in summer and autumn. Maximal value is 479 grains per 3.24 cm² on 1st July.

Pteridium: Spores appear from May to November. Maximal value is 267 grains per 3.24 cm² on 7th July.

In addition to the common airborne pollen and spores described above there are still some other pollen and fern spores which are present in small quantity in the atmosphere of Nankang. They are mentioned in the Table 1.

DISCUSSION

Based on the results of seasonal variation of airborne pollen grains and fern spores the occurring period of the palynomorphs may largely be divided into four groups of plants, namely tree, weed, grass and fern. Tree flowers bloom mostly in the spring, for example, *Pinus*, *Juniperus-Cunninghamia*, *Myrica*, *Broussonetia*,

Celtis, *Ligustrum*, *Bischofia*, *Podocarpus*, *Casuarina*, *Trema*, *Acacia confusa* and *Mallotus japonicus*. *Salix* and *Morus* flower at the end of the winter or at the beginning of the spring. There are still some other common anemophilous trees which bloom in the autumn, like *Alnus*, *Mallotus paniculatus* and *Melaleuca*. Weeds flower mostly in the autumn, eg. *Artemisia*, *Ambrosia* and *Humulus*. Grasses flower throughout the year, but especially in the autumn. Fern spores mature in the summer. There were many fern spores in the atmosphere of Taipei from June to November. They reached their maximal counts in July due to many catches of *Alsophila*, *Dicranopteris* and *Pteridium*.

In the sampling site Nankang, a great deal of the airborne pollen in the spring are of either 2- or 3- porate pollen grains. They are similar in size and wall sculpture examined under light microscope and therefore it is difficult to determine the species. The study of pollen morphology with scanning electron microscope can provide in this case more precise information for the identification of pollen species. A survey to distinguish the pollen of some taxa with the aid of SEM such as *Broussonetia*, *Morus*, *Humulus*, *Celtis*, *Trema* and *Boehmeria* was made and it is prepared for publication in the future.

Plants of *Picea*, *Abies* and *Tsuga* are growing only in the central range of Taiwan, usually 2,000 m above the sea level (Li, 1975). The occurrence of these pollen in the sampling station is recognized as a result of long distance transport of pollen, that is not seldom for airborne pollen (Mandrioli, 1982).

Weed pollen grains present in the sampling station with only a low percentage. However, they are of greater importance in allergology (*Mallea et al.*, 1978). *Ambrosia elatior* is one of the most important allergic pollen and found in the atmosphere at Nankang, Taipei. Before 20 years there was no record of the existence of this American ragweed in Taiwan. It was therefore considered that there was probably no pollinosis resulted from this weed (Chao *et al.*, 1962). In recent years *Ambrosia* plants are commonly found in Taiwan (Han *et al.*, 1976; Li, 1978). The reason for the abrupt appearance of this plant is still unknown. *Artemisia* is also one of the pollen species resulting in allergy. Its pollen counts are in general low at Nankang. The importance of this pollen species in the atmosphere is however not decided by its frequency of presence, as the case mentioned by Nilsson & Palmberg-Gotthar (1982).

In the autumn, *Melaleuca leucadendra* and *Eucalyptus robusta* were the pollen, as mentioned by Chao *et al.* (1962), as the main species causing allergy. Furthermore, *Alnus* pollen, which was not noted by previous authors, also appear in the sampling station. It could therefore be an important pollen that also is resulted in pollinosis, in spite that its clinical manifestation is not a servere one (Spieksma, 1983). At Nankang, the greatest quantity of pollen grains of the Gramineae species are recorded in November with a dominant species of *Miscanthes* pollen. Gramineae pollen is the most frequent cause of hay fever in those countries with a moderate continental climate (Yankova, 1978). For multispecies assemblage, such as Gramineae, the period of maximum concentration is very difficult to predict.

The diurnal fluctuation of pollen concentrations in the air is dependent on the release rhythm of the innate pollen. The rhythm is modified largely by the preceding and prevailing weather conditions (Käpylä, 1981). The correlation between meterological factors and common airborne pollen release in Taipei have been discussed (Chen & Huang, 1980).

The pollen quantities and the pollination period can differ from one year to another owing to change in meteorological factors (Engström & Nilsson, 1978; Bringfelt, 1978) and phenological conditions of plant itself. The comparison of airborne pollen in different stations and various years has been made in several countries (Lejoly-Gabriel & Leuschner, 1983; Spieksma, 1983). In order to ascertain the reliability of this data, the work of this investigation must be continued for years.

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臺北(南港)空中孢粉之研究

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摘 要

研究觀察1983年在南港所收集的空中孢粉，發現春天空中的孢粉種類及數量居全年之首，大多爲樹種之花粉，例如：松樹、龍柏——杉木、楊梅、櫧樹、朴樹、女貞、茄冬、羅漢松、木麻黃、山黃麻、相思樹及野桐等；柳樹及桑樹則多在冬末初春開花。夏天則多爲蕨類孢子，例如栗蘭、芒萁、蕨、腎蕨、瓦葦等屬及一些雜草的花粉，如藜科。秋天主要的優勢種有白鴉子、楹木、白千層及禾本科，以及一些雜草的花粉，如艾屬、豬草及蒲草等。冬天空中花粉種類少，多爲禾本科。孢粉屑亦在文中一併被列出。