PLANT POLLEN PRODUCTION IN SELECTED TREE SPECIES

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Apart from its essential function in seed plant reproduction, pollen is well known as a food source, as a cause of allergies, and as an indicator of palaeovegetation (Stanley & Linskens, 1974).

Few accurate estimates of the dry weight of pollen produced by flowers of angiosperms and male cones (strobili) of gymnosperms are available (Fielding, 1960). Observations after rain, in spring, reveal yellow "tidemarks" around streams and pools and circumstantially suggest that large amounts of pollen are produced per annum and blown around in nature. Most pollen, particularly in anemophilous species, does not fall on stigmata (or ovule drops of gymnosperms) and, as a result, this unused pollen becomes a potential food source for soil organisms. Pollen contains important nutrients such as N, P and K (Knight *et al.*, 1972) and small nutrient-rich inputs can be expected when pollen enters the soil system. Since plants produce pollen at specific times of the year the input of nutrients from this source to soils and water bodies will, at least locally, occur as a series of regular pulses.

Using trees at Canterbury University campus, Woodham Park, Christchurch Botanic Gardens and the Cass region, Canterbury, I have determined (by direct weighing) the amount of pollen produced per flower/cone and estimated (from photographs) the numbers of flowers or male cones, that were present on the sampled trees, to extrapolate total amounts of pollen produced by those trees.

METHODS

Photographs with good depth of field were taken of the whole side of a tree at or just before flowers/cones were releasing pollen, in spring, (spread, for different species, from 1989 - 1995). Once developed, photographs were placed under a cool light source microscope and individual flowers/cones counted using a fine-tipped black pen and a hand counter. Counts were doubled to obtain flower numbers per plant (as the photographic images of plants were regarded as two-dimensional for my study).

Following photography, about 20 catkins/flowers/cones were carefully collected, and insects and debris removed, before drying at 50°C for four days and weighing with an A&D electronic analytical balance. After this they were lightly crushed and rubbed gently through a series of sieves of decreasing mesh sizes (200, 149, 74, 53 and 37 μm). In most cases clean pollen was obtained after passage through the 37 μm mesh sieve. The pollen was weighed and the percentage weight of inflorescence/flower/cone contributed by pollen was calculated. Weights of pollen per tree were calculated by multiplying individual flower/cone pollen weights by the total number of flowers/cones determined for each tree by photography.

RESULTS

Results are presented in Table 1. The proportion of total flower/cone weight that was pollen was generally highest in male cones of gymnosperms, followed by angiosperms with male flowers borne in catkins. Flowers of angiosperms that are borne in looser inflorescences (with insect- or bird pollination) have the lowest proportion.

Due to accessibility and weather problems, which hindered regular visits to some trees during the pollen season and the difficulty of observing every flower/cone, it is likely that at least some of the values in Table 1 are underestimates. The trees used in my study were mainly young and although there are many factors affecting annual pollen production (such as soil water and nutrients) it is probable that these trees had not yet begun to produce maximum pollen loads. Even so, the amounts produced by the oaks and pines are large. If one assumes that, in natural habitats there could be 300 similarly-aged trees per hectare, then this suggests that fallout could be 400-4000 kilograms of pollen, per hectare, per year. These values considerably exceed those given by Brooks (p. 31, Stanley & Linskens, 1974) but approach those given for *Pinus radiata* (700 kg/ha) by Fielding (1960).

Although I have presented new data the main idea behind this study can be attributed to an extremely farsighted forest ecologist called H. Hesselman who in 1919 suggested, based on some good, careful experimental work, that the "spruce forests of southern and middle Sweden produce about 75 000 tons of pollen per year". I note that in Shaw (1971) Hesselman's estimate has become translated into the whole of Sweden producing only 75 000 lbs, or 34 metric tonnes!

Table 1 Pollen estimates for some Canterbury trees

Species	Tree age/years	Location	% flower/cone weight that was pollen	kg total dry weight of pollen per tree
Angiosperms				
*Betula pubescens**	25	U.C.	34	0.42
Crataegus oxyacantha†	30	U.C.	1	0.01
Hoheria angustifolia†	20	U.C.	2	0.01
*Juglans regia**	40	U.C.	31	0.65
Leptospermum scoparium†	40	Cass	1	0.04
*Nothofagus solandri***	90	Cass	15	1.36
Plagianthus regius†	50	U.C.	2	0.11
Pterocarya x *rehderama**	30	W.P.	22	0.46
*Quercus dentata**	60	W.P.	19	2.63
*Quercus palustris**	20	U.C.	29	0.21
*Quercus robur**	40	U.C.	40	1.50
Sophora microphylla†	25	U.C.	2	0.02
Gymnosperms				
Abies grandis	35	C.B.G.	28	0.65
Cedrus atlantica	40	U.C.	45	6.25
Cunninghamia lanceolata	40	C.B.G.	26	0.81
Picea omorika	19	C.B.G.	57	5.6
Pinus banksiana	8	C.B.G.	31	0.19
Pinus canariensis	28	C.B.G.	58	14.4
Pinus halepensis	NR (20)	C.B.G.	51	ND
Pinus montezuma	36	C.B.G.	37	0.34
Pinus pinaster	25	U.C.	43	4.64
Pinus ponderosa	NR (50)	C.B.G.	60	ND
Pinus silvestris	35	U.C.	49	3.96
Pinus thunbergii	36	C.B.G.	49	ND

U.C. - University of Canterbury Campus, W.P. = Woodham Park, C.B.G. = Christchurch Botanic Gardens, NR = no record of planting date (estimate given), ND = not done.

* angiosperms with catkins, wind-transported pollen; ** angiosperm whose single flowers have many, crowded stamens, wind-transported pollen; † angiosperms with larger flowers, not tightly clustered, insect- or bird-transported pollen; the rest are gymnosperms with male cones, wind-transported pollen

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Herbarium News

The official abbreviation acronym for the herbarium of the Department of Plant and Microbial Sciences (PAMS) at the University of Canterbury is CANU. There have been moves, lately, to develop a database to be known as Type Records of Yeasts, Mycota and Erysiphales, which will, of course, be known by the acronym TRYME.