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SEASONAL CHANGES IN THE POLLEN SAMPLED FROM NECTARIVOROUS BIRDS VISITING AN OPEN FOREST AT MENAI, NEW SOUTH WALES

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Pollen was sampled from the foreheads of 1 046 individuals of seven honeyeater species which were captured in mist nets in an open woodland near Sydney. Four species of honeyeaters were winter visitors and were present in the site during the period of peak flowering. Pollen of *Banksia* spp. dominated the sample reflecting the relative abundance of *Banksia* spp. in the study site. The contribution of different flowering plants to the diet of some species of honeyeater varied throughout the year as expected. This variation resulted from both the seasonal pattern of flowering and the presence or absence of the honeyeater species when different plants were in flower. There is some evidence that both interspecific competition between honeyeater species and the degree of morphological compatibility between flower and bird head shape contributes to the variation in diet.

INTRODUCTION

Honey-eating birds have been the subject of several studies on foraging and partitioning of food resources (Ford and Paton 1982; Pyke 1985; Pyke *et al.* 1989). The degree to which nectar and insects are represented in the diet may vary between species (Pyke 1985). Even within the same species the relative proportion of insects and nectar can vary with the location of the study site (Pyke 1985) and the season (Pyke and Recher 1987). Furthermore, different species of plant often flower at different times of year.

The contribution of nectar sources to the diet of honeyeaters can also change both seasonally and geographically.

The aim of this study was to determine what flowers were being visited by the different honeyeater species frequenting an area of open forest at Menai, New South Wales, to measure differences in the extent particular plant species were used by different honeyeater species, and to identify seasonal changes in resource use.

METHODS

The study took place on Crown land approximately 2 km west of Menai, a southern suburb of Sydney, New South Wales (34°01′00″S, 151°00′00″E). The site encompasses 1.5 ha of woodland situated on a sandstone ridge 90 m above sea level. The site has an abundance of *Banksia* species and supports a profusion of honeyeaters during autumn and winter when most *Banksia* species are flowering.

The tree species present in the study site are *Angophora costata, A. bakeri, Eucalyptus gummifera, E. haemastoma* and *E. piperita*. The understorey is thick and dominated by *Banksia ericifolia*. Other understorey species include *B. marginata, B. oblongifolia, B. spinulosa, B. serrata, Lambertia formosa, Grevillea buxifolia, G. sericia, G. mucronulata, Hakea sericia, H. teretifolia, Persoonia pinifolia, P. levis, Epacris microphylla,* and *Leptospermum* spp. The mistletoe *Dendrophthoe vitellina* is also present at the site as a parasite of *E. gummifera* which is the dominant tree species at the site. Plant species in the study area were identified using Costerman (1989), Cronin (1988), Edmonds and Webb (1986) and George (1987).

Site visits

The site was visited for four hours once per week (weather permitting) between April 1989 and October 1993. Four 12 m and two 9 m long mist nets with 32 mm mesh diameter were erected at fixed net sites on each visit. Trapping took place between 0700 hrs and 1100 hrs (March to September) and from 0630 hrs to 1100 hrs (October to February). All birds captured were banded with bands supplied by the Australian Bird and Bat Banding Scheme. Morphometrics were also recorded including the weight, length of head bill, wing and tail. Sex was also determined where possible.

On each visit to the site, observations were made on whether the dominant plants were or were not in flower.

Pollen analysis

Pollen was sampled from 46 per cent of all honeyeaters captured using the technique described by Wooller *et al.* (1983). A 2 mm cube of sticky gelatine incorporating a fuchsin dye is rubbed on the bird's forehead and bill and then placed in a separate container. Each cube is later melted on a glass slide under a cover slip so it can be viewed under a microscope.

The prepared samples were viewed, and pollen grains were counted, using a plain light microscope at 100x magnification. Counts of less than 10 pollen grains per sample were disregarded because contamination from nets or different pollen deposited on blooms by other pollinators could account for such small counts. Seventy per cent of samples yielded in excess of 100 pollen grains.

The eucalypts were identified only to genus, and no attempt was made to distinguish the very similar pollen grains of *B. ericifolia* and *B. spinulosa.* These two *Banksia* species flower simultaneously, but *B. spinulosa* is not abundant at the study site. The assumption was made that pollen identified as one or the other, was most likely from *B. ericifolia.*

RESULTS AND DISCUSSION

The flowering periods of the dominant plant species found in the study site are shown in Figure 1. The *Eucalyptus* species flowered sporadically but there was at least one species of eucalypt flowering during the winter influx of honeyeaters.

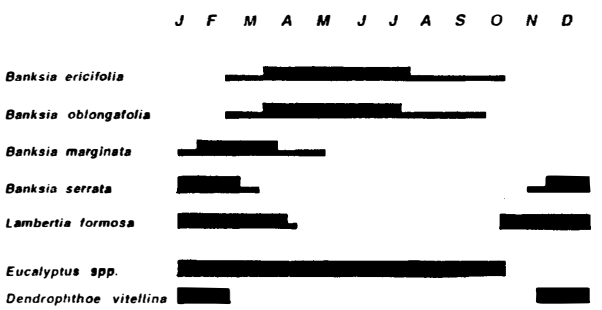

Figure 1. *Flowering periods of various species of trees and shrubs at the study site. The narrow section indicates the commencement of spikes on the* Banksia *and the fading of the flowering. The flowering varied from year to year in the number of inflorescences produced.*

Seven of the 12 species of honey-eating birds captured at the study site were sampled in sufficient numbers to allow meaningful diet analysis. These species were New Holland Honeyeater *Phylidonyris novaehollandiae*, Yellow-faced Honeyeater *Lichenostomus chrysops*, Eastern Spinebill *Ancanthorhychus tenuirostris,* Little Wattlebird *Anthochaera chrysoptera*, Red Wattlebird *Anthochaera carunculata*, Noisy Friarbird *Philemon corniculatus*, and the nectivorous Silvereye *Zosterops lateralis.*

New Holland Honeyeaters, Eastern Spinebills and Little Wattlebirds were present at the study site all year round. Yellow-faced Honeyeaters (Fig. 2) and Silvereyes (Fig. 3) were regular winter visitors to the study site whereas the Red Wattlebird (Fig. 4) and Noisy Friarbird (Fig. 5) were also winter visitors but were not present every year. The Noisy Friarbird was only recorded during 1990 and 1993 and the Red Wattlebird in 1992 and 1993. The number obtained for the latter two species were the weekly average of a transect count of 20 minute duration on each visit to the study site. The above method was used for the latter two species as they were more numerous than the capture rate shows, whereas the other species were mist netted in greater numbers.

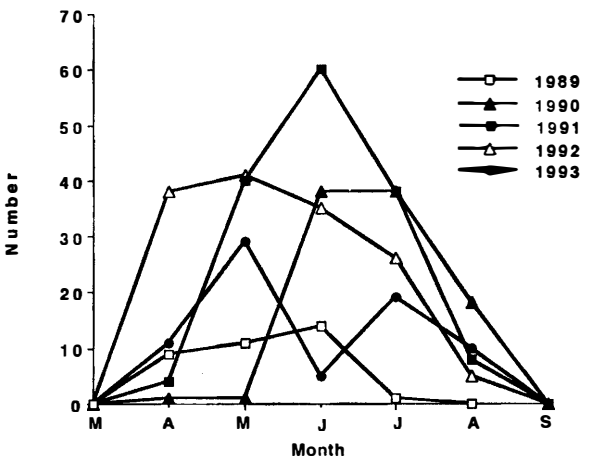

Figure 2. *Number of Yellow-faced Honeyeaters trapped each month each year.*

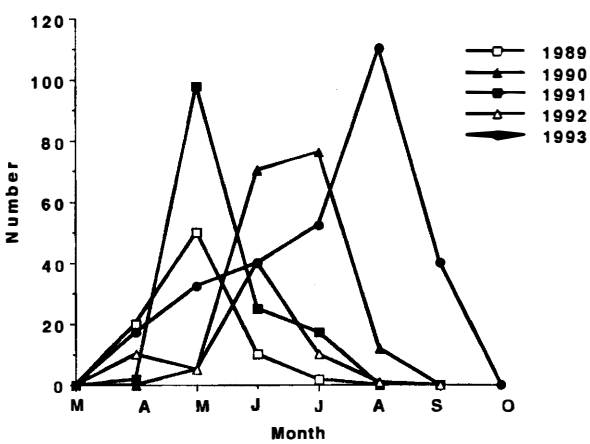

Figure 3. *Number of Silvereyes trapped each month each year.*

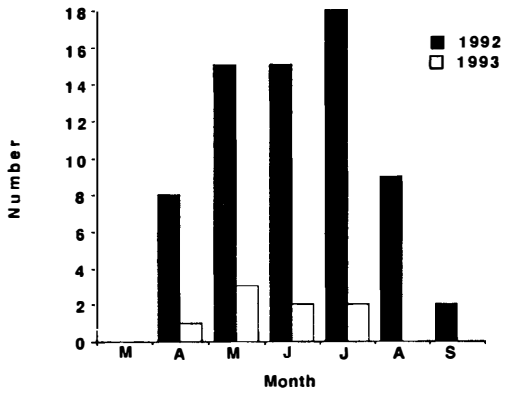

Figure 4. *Average weekly counts of Red Wattlebirds at study site 1992 and 1993.*

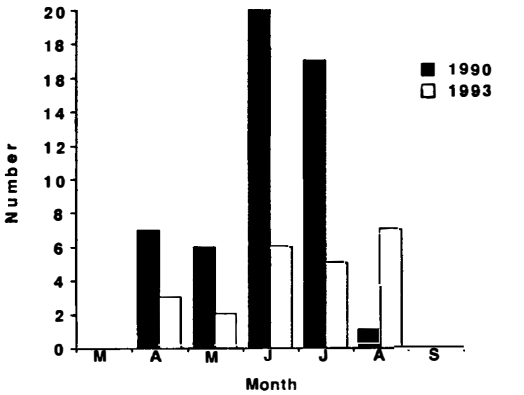

Figure 5. *Average weekly counts of Noisy Friarbirds at study site at 1990 and 1993.*

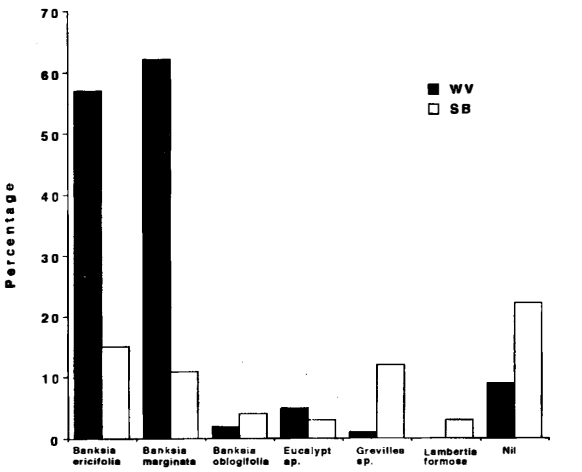

Figure 6. *Winter visiting honeyeaters (WV) pollen samples compared to those of the Eastern Spinebills (SB) during the same period. WV, n = 510; SB, n = 210.*

Pollen of *Banksia* spp. was the most commonly sampled, though inflorescences of other species were also available (Fig. 6). Other sources such as *Eucalyptus* spp. and *Angophora* spp. were found on only a few honeyeaters (Tables 1 and 2). Eastern Spinebills and New Holland Honeyeaters showed the most varied diet of all the species since they were recorded foraging on eight different plant species. The Eastern Spinebills had pollen from as many as four plant species taken from a single bird (Tables 3 and 4). These two species are present at the study site all year so have access to plants that do not flower during the winter months. However, the percentage of spinebills sampled with no pollen increased from 16 per cent and 28 per cent for most of the year, up to 41 per cent during April/May. Ford (1982) and Farrell and Hardy (1993) suggest that the zero pollen counts may result from the long bill preventing the contact between the birds forehead and the flower itself.

During the winter months *B. ericifolia* and *B. marginata* accounted for more than 50 per cent of pollen on the larger honeyeaters, whereas on no occasion did these plant species account for greater than 50 per cent of pollen for Eastern

TABLE 1

Percentage of Silvereyes carrying pollen from species of plants. All years data combined. n = number of birds.

Pollen	A	M	J	J	A	S
Banksia ericifolia	45	58	66	71	45	33
Banksia marginata	100	76	66	50	90	100
Banksia oblongifolia	27	3				
Eucalyptus spp.	27	3				
Angophora spp.	5					
Nil		3			27	
n =	18	30	20	25	11	6

TABLE 2

Number of Noisy Friarbirds carrying pollen from samples present at the study site that indicate consistent foraging in both years they were present. n = number of birds.

Pollen	A	M	J	J	A
Banksia ericifolia			9	3	5
Banksia marginata	2		5	4	5
Banksia oblongifolia	1		9		
Angophora spp.					2
Nil				1	
n =	2		9	6	5

TABLE 3

Percentage of Eastern Spinebills carrying pollen from species of plants. All years data combined. n = number of birds.

Pollen	J	F	M	A	M	J	J	A	S	O	N	D
Banksia ericifolia			36	27	36	33	30	35	25			
Banksia marginata		30	45	37	33	37	40	25	50			
Banksia oblongifolia		20	27	26								
Banksia serrata	43	40										27
Lambertia formosa	20	80	32	26	2		2	3		21	83	76
Grevillea mucronulata	14		4	23	15	25	26	50	7	57		18
Eucalyptus spp.	14	20								28	66	
Dendropthoe vitellina	10	80										45
Nil		18	20	38	41	25	21	25	16	7		
n =	7	5	22	30	28	12	37	28	4	14	6	11

TABLE 4

Percentage of New Holland Honeyeaters carrying pollen from species of plants. All years data combined. n = number of birds.

Pollen	J	F	M	A	M	J	J	A	S	O	N	D
Banksia ericifolia		19	8	31	62	66	83	93	83	50		
Banksia marginata		45	83	83	62	38	76	56	83	41		
Banksia oblongifolia		22	50	43	12							
Banksia serrata	84	64	4								55	100
Lambertia formosa	19	16	8							26	83	100
Grevillea mucronulata	3					4		5	11	26	55	
Eucalyptus spp.	30	3	4					1	5	56	66	
Dendropthoe vitellina	11	6	8								55	
Nil		6	4			14	3					
n =	26	31	24	23	8	21	27	70	71	27	9	2

TABLE 5

Percentage of Yellow-faced Honeyeaters carrying pollen from species of plants. All years data combined. n = number of birds.

Pollen	A	M	J	J	A	S
Banksia ericifolia	50	54	74	66	62	50
Banksia marginata	90	54	63	74	57	100
Banksia oblongifolia	9	9				
Lambertia formosa	1					
Grevillea mucronulata	1	6				
Eucalyptus spp.	1		3	3		
Nil	12	7	1	1		
n =	68	63	62	54	21	2

Spinebill. Ford (1982) suggests that the exclusion by other species of honeyeaters could cause this. Little Wattlebirds were observed chasing some of the smaller honeyeaters from *B. ericifolia* on several occasions.

Yellow-faced Honeyeaters were only present from April to August (Fig. 2) and as this does not correspond to the November to February flowering period of *B. serrata* and *Dendrophthoe vitellina* (Fig. 1), it is not surprising that these species of plant were not recorded in their diet (Table 5). The higher percentage of total lack of pollen on Yellow-faced Honeyeaters during April compared

TABLE 6

Percentage of Little Wattlebirds carrying pollen species all years. n = number of birds.

Pollen	J	F	M	A	M	J	J	A	S	O	N	D
Banksia ericifolia		71	76		33	71	76	100	100			
Banksia marginata		43	100	100	33	40	87	66	86			
Banksia serrata	66		100									100
Lambertia formosa											100	100
Eucalyptus spp.											100	
Dendropthoe vitellina	32											
Nil			33		33	10	12					
n =	3	7	3	1	3	10	8	11	7	0	1	1

TABLE 7

Number of Red Wattlebirds carrying pollen samples that were trapped at the site both years. n = number of birds.

Pollen	A	M	J	J	A
Banksia ericifolia	2	12	1	7	
Banksia marginata	6	10	11	6	6
Banksia oblongifolia	6				
Grevillea spp.	1				
n =	6	12	14		

to pollen loads recorded in other months, suggests that these birds were transitory and not feeding in the area.

New Holland Honeyeaters fed on eight species of plant pollen (Table 4), but their diet was dominated more by a single genus than was that of the Eastern Spinebill. *B. serrata* was the most common species in their summer diet with *B. marginata* and *B. ericifolia* dominating through the rest of the year.

Silvereyes had a very similar diet to Yellow-faced Honeyeaters foraging mostly on *B. ericifolia* and *B. marginata* in equal proportions.

Overall the study shows that numerous species of nectar feeding birds used a variety of inflorescences in the study site and that they track changes in plant flowering activity. They show preferences for particular nectar sources even when a variety is available (Tables 1, 2, 5, 6 and 7). Others appear to feed evenly on available sources (Tables 3 and 4).

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