

Feeding Times of Honeyeaters on *Banksia ericifolia* Inflorescences

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Feeding times of honeyeaters on *Banksia ericifolia* inflorescences were studied. Territorial Red Wattlebirds *Anthochaera carunculata* had a significantly longer mean feeding time/inflorescence than non-territorial (opportunistic) individuals, and there were large differences between those of opportunistically foraging Eastern Spinebills *Acanthorhynchus tenuirostris*, New Holland Honeyeaters *Phylidonyris novaehollandiae* and Crescent Honeyeaters *P. pyrrhoptera*. Reasons for these differences are discussed, as are the distribution ranges and standard deviations of the visiting times of each species.

Although there have been many studies on the interaction between nectar-producing flowers and their pollinating visitors, there are few published data on the range of rewards that these visitors encounter whilst foraging (Pleasants and Zimmerman, 1983). The amount of nectar that flowers contain is a function both of the rate at which it is produced and of the time elapsed since the last feed by a visitor. Each visitor, uninfluenced by previous visitors in its choice of flowers, can therefore expect a broad range of rewards as it moves from one flower to another. Since their movements are easy to see and to quantify, birds are particularly convenient subjects for plant-pollinator studies.

The birds in this study were honeyeaters. The aim was to analyse the feeding times of (i) territorial Red Wattlebirds *Anthochaera carunculata* which defended a feeding territory; and

(ii) of non-territorial Red Wattlebirds and other species. Within this framework two questions were asked: (i) what is the effect of territorial behaviour on the distribution range of feeding times on inflorescences? and (ii) confronted by the same inflorescences, do different species have different feeding times and, if so, why?

Materials and Methods

The study took place in the National Botanic Gardens, Canberra. Observations, totalling 26.6 hours, were made from 21 May - 19 June, 1983 (Table 1). The feeding sites comprised two bushes of *Banksia ericifolia*, about 10 metres apart, and each bearing 200-300 nectar-producing inflorescences, about one third of which were in view from the observation point. When a visitor feeds at an inflorescence it exploits, in

TABLE 1

Number and mean length of visits (sec) of five species of honeyeater to *Banksia ericifolia* between 21 May and 19 June 1983.

	May 21	May 22	May 28	Daily data					
				May 29	June 5	June 13	June 15	June 18	June 19
Hours of observation	2.00	3.50	3.25	3.00	4.00	5.00	1.75	3.08	1.08
Number and mean length of visits (sec)									
Red Wattlebird (territorial)	0	0	23(33.2)	4(38.6)	34(37.9)	19(52.7)	8(42.0)	12(53.0)	0
Red Wattlebird (non territorial)	0	26(24.7)	0	0	0	10(28.4)	3(6.8)	0	0
New Holland Honeyeater	29(19.7)	17(17.7)	27(19.8)	20(25.8)	5(18.5)	11(15.0)	11(22.0)	4(20.9)	10(17.3)
Eastern Spinebill	31(30.4)	30(35.7)	0	30(34.5)	43(30.2)	79(26.9)	37(22.9)	61(26.5)	14(30.9)
Crescent Honeyeater	11(21.6)	1(25.1)	8(26.8)	12(10.2)	4(13.1)	18(14.7)	4(19.7)	13(8.1)	8(13.7)

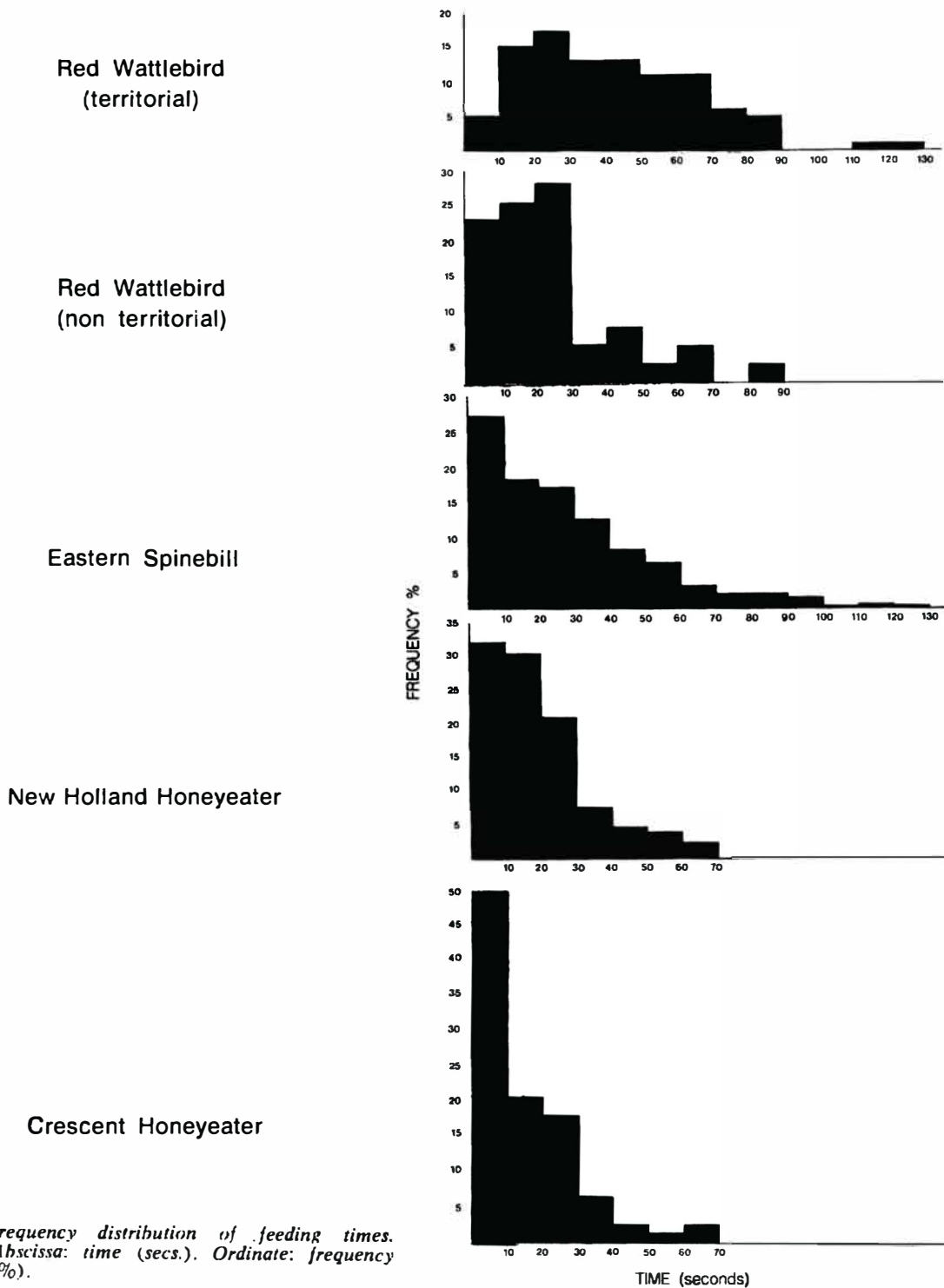


Figure 1. Frequency distribution of feeding times. Abscissa: time (secs.). Ordinate: frequency (%).

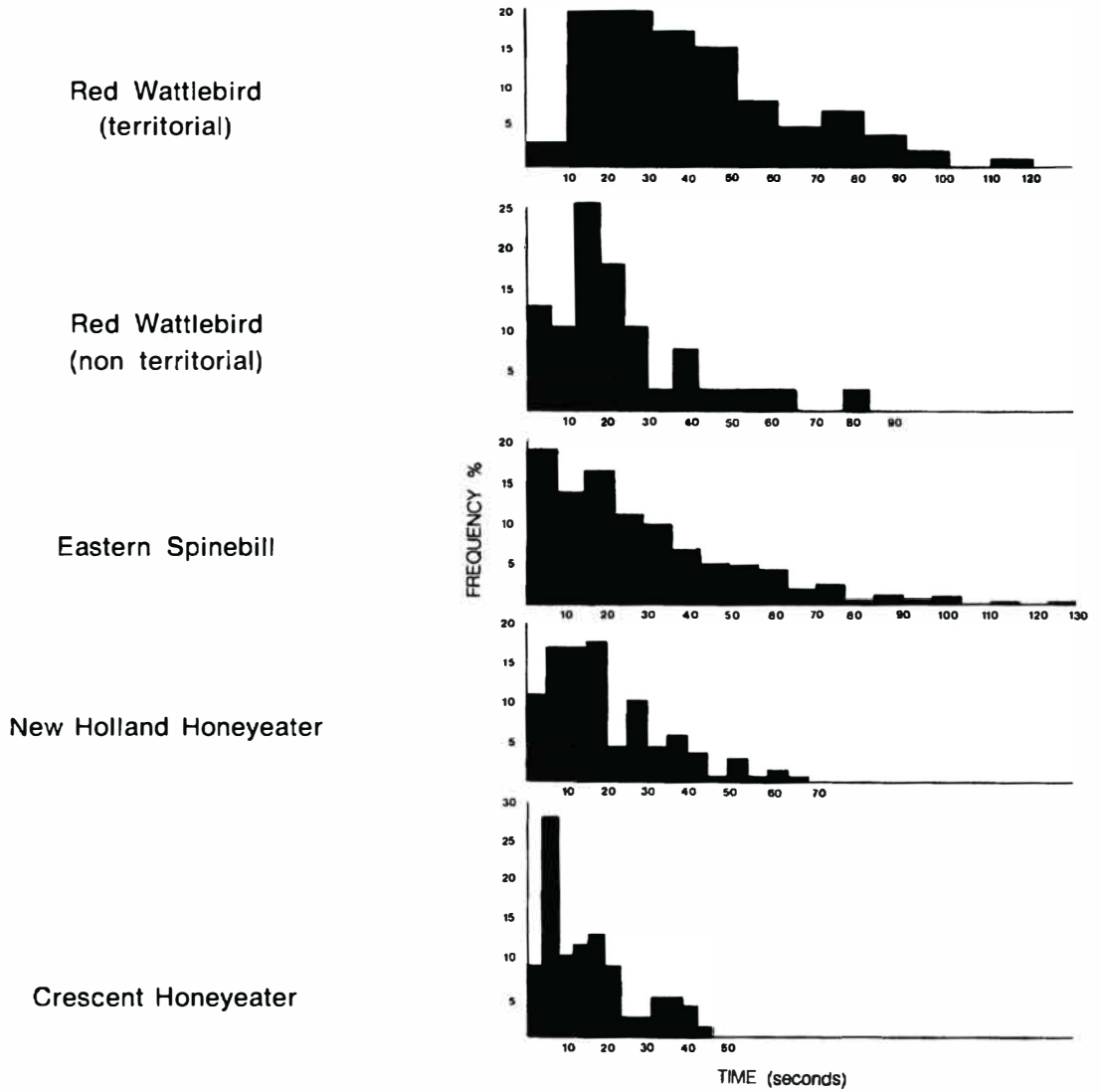


Figure 2. Distribution range of feeding times (for explanation see text). Abscissa: time (secs.). Ordinate: frequency (%).

effect, the nectar produced by the many small flowers of which this is composed.

Five species of honeyeaters (Meliphagidae) were seen visiting the bushes. Red Wattlebirds, when present, defended parts of the bushes by chasing away both conspecifics and other species. These were the New Holland Honeyeater *Phylidonyris novaehollandiae*, the Crescent Honeyeater *P. pyrrhoptera*, the Eastern Spinebill *Acanthorhynchus tenuirostris* and the White-eared Honeyeater *Lichenostomus leucotis*. The latter species made only eight visits and is not considered further. No species apart from the Red Wattlebird defended a territory.

Each feeding visit to an inflorescence was watched through 10 x 50 binoculars and timed, by digital watch, to begin when a bird began feeding and ceased when the bird moved away from the inflorescence. Feeds were often interrupted by the birds looking around. If these interruptions lasted longer than five seconds, then timing was stopped, only to restart on the resumption of feeding. If, because of aggression by another bird, a visitor left the "censored" inflorescence on which it was feeding, its visit was discounted. Only completed, clearly visible visits were timed, all others being ignored.

Results and Discussion

Data for both bushes are pooled.

Table 1 shows results for each day of observations. Of particular note is the daily variation in the numbers and species composition of visitors.

Figures 1 and 2 show overall results graphically in two different ways. In Figure 1 the times spent at inflorescences are plotted directly whereas in Figure 2 they are expressed as proportions of the mean visit time/species/day. This was done as an attempt to minimise the day-to-day variation mentioned above. After the mean visit for each day was calculated, all visits on that day were then classed as proportions of this mean (0.50-0.75, 0.75-1.00, etc.). The first column in Figure 2 therefore represents visits for all days which were in the 0.00-0.25 proportion class of the day on which they occurred. The interface of columns 4 and 5 represents the overall mean visiting time.

Territory-holding Red Wattlebirds had not only the longest mean visiting time/inflorescence of 41.8 sec. (Table 2) but also a very different frequency distribution of times (Figures 1 and 2) compared with that of non-territorial (opportunistic) Red Wattlebirds and other species. The range shows a very low proportion of short, thus relatively unrewarding, visits, and a high proportion of long-lasting visits.

The most frequent visitor, the Eastern Spinebill, had the next highest mean visiting time (Table 2). Both Figures 1 and 2 indicate a relatively large proportion of short visits and a small proportion of long ones. Nearly 50% of visits by the Crescent Honeyeater lasted less than 10 sec., none was longer than 60 sec., and the mean was only 15.3 sec. New Holland Honeyeater visits were intermediate in all these respects: the mean visiting time was 20.0 sec. and the proportion of short visits was greater than that of the Eastern Spinebill and less than that of Crescent Honeyeater.

The Red Wattlebirds that were not defending territories had a mean visiting time/inflorescence of 24.3 sec., considerably (and significantly: $p = < 0.001$ 't' test) less than that of territorial individuals and a little less than that of the Eastern Spinebill. The slightly different distribution pattern of visiting times from those of other species is hard to explain: possibly it results from the relatively small sample size ($n = 39$). If, however, the standard deviations of the visiting times of each species are plotted against the means (Figure 3), it became clear that these feeds by non-territorial Red Wattlebirds comply with the pattern formed by the three other species.

TABLE 2

Pooled data for all days of observation.

	No. of visits	Mean visiting time (sec)	Standard deviation
Red Wattlebird (territorial)	100	41.8	24.4
Red Wattlebird (opportunistic)	39	24.3	19.1
New Holland Honeyeater	134	20.0	15.1
Eastern Spinebill	325	28.6	24.4
Crescent Honeyeater	79	15.3	13.7

Furthermore they strongly contrast with the very low ratio of standard deviation to the mean of the visiting times of territorial Red Wattlebirds. What the latter thus managed to do was not only, on average, to have longer feeding times at inflorescences but also to reduce the chances of the occurrence of very short, and unrewarding, visits. That birds may show a preference for a more predictable range of food rewards (i.e. with a small standard deviation) was shown by Caraco (1983) in an experimental approach involving White-crowned Sparrows *Zonotrichia leucophrys*. However, whereas these birds preferred rewards with a greater standard deviation when facing an energy deficiency, Red Wattlebirds on Kangaroo Island have been observed to adopt territoriality around rich nectar sources when nectar was limiting (Ford and Paton, 1982). The daily variation

in energy/nectar availability may explain why in this study the *Banksia* bushes were not defended at all times.

Differences between the non-territorial species in the means and distribution ranges of their feeding times have been pointed out, but why do they occur? There is no relationship with body-weight. One partial explanation could be a rate of nectar assimilation characteristic of each species, each perhaps best at exploiting particular nectar volumes. However the daily variation in visitation patterns, along possibly with that in rates of nectar production, preclude anything but speculation. Further study on this topic would need to focus attention (i) on feeding times at individually marked inflorescences and (ii) on the rate of, and variation in, nectar production by such inflorescences.

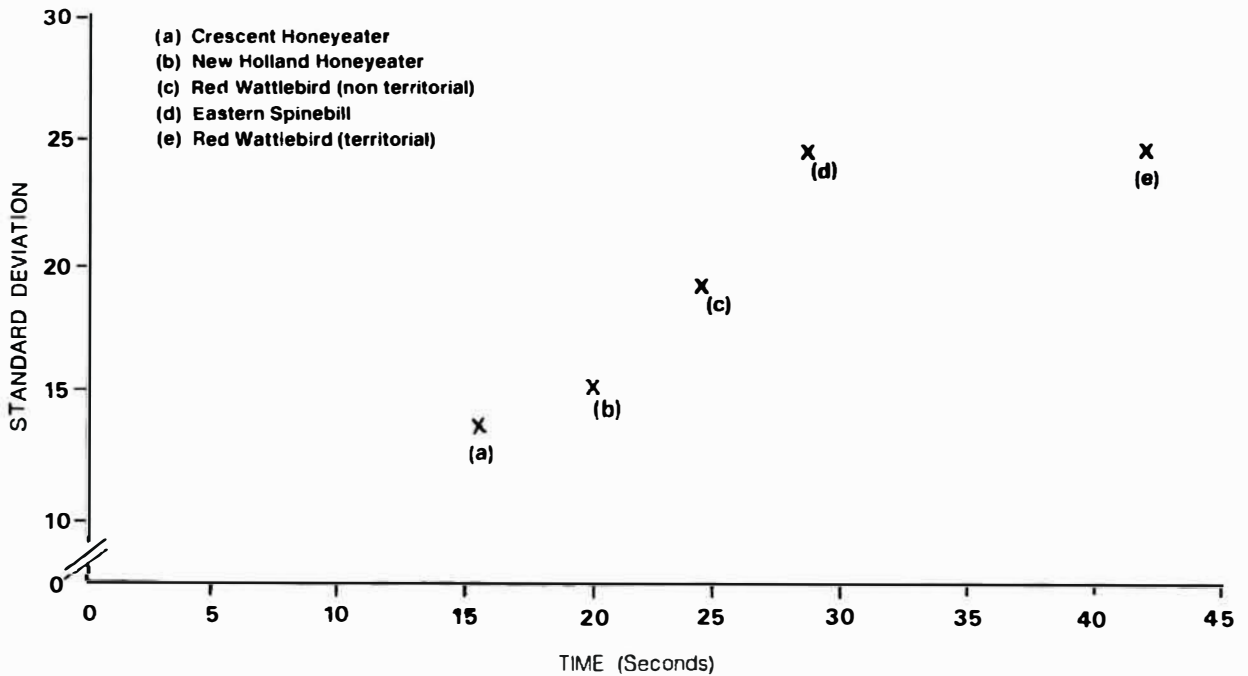


Figure 3. Visiting times of honeyeaters to *Banksia*. Abscissa: mean visiting time (secs.). Ordinate: standard deviation of visiting times.

Acknowledgement

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References

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