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Notes on the Nesting Biology of the Spotted Bowerbird *Chlamydera maculata* (Ptilonorhynchidae)

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Summary

A nest of the Spotted Bowerbird *Chlamydera maculata* was studied and its structure, situation, location relative to a bower, eggs, nestlings and their nestling periods described and compared with those of congeners. Results of 55 h of observation of nestling care are presented and discussed. Of 359 identifiable nestling meals 213 were animal and 146 were fruit. Of animal meals, 58% were grasshoppers or crickets, and of fruit meals, 57% were from the Currant Bush *Carissa lanceolata*. A single parent, presumably female, attended the nest and performed vocal mimicry, particularly of calls of predatory birds. Clutch size and breeding seasons in the Spotted and Western *C. guttata* Bowerbirds are reviewed.

Introduction

The Spotted Bowerbird *Chlamydera maculata* is a member of the only bowerbird genus adapted to dry, sparsely vegetated habitats and is endemic to Australia, where it frequents dry, open, grassy woodlands and inland riverine vegetation of eastern Australia. The distribution of the closely related Western Bowerbird *C. guttata* is thought to be associated with that of figs *Ficus* spp., notably *F. platypoda* (Serventy & Whittell 1962, Storr 1977, Storr & Johnstone 1970, Pizzey 1980) and because this bowerbird has long been considered a subspecies of *C. maculata*, this association with figs has also been credited to the latter bird. The sexes of the Spotted Bowerbird, and of its congeners, are almost identical morphologically, as described by Gilliard (1969), Cooper & Forshaw (1977), Schodde & Tidemann (1986) and others. Males build an 'avenue'-type bower of grasses and fine twigs, which they decorate with numerous objects and at which they court and mate with females (Marshall 1956, Gilliard 1969, Cooper & Forshaw 1977, pers. obs.). The courtship behaviour of *Chlamydera* bowerbirds is indicative of a promiscuous male mating system, in which females are known or assumed to raise offspring unaided, because of what is known of other bower-building species (Gilliard 1969, Cooper & Forshaw 1977, Donaghey et al. 1985, Diamond 1986, Borgia 1986, Frith & Frith 1989, 1990).

Clutch size of the Spotted and Western Bowerbirds is 1 to 3 eggs, most frequently 2. Their breeding season [as indicated by egg(s) and/or young in nest] is August-February, the exact months and length of season apparently varying from year to year as a function of local rainfall (Campbell 1901, North 1902, Robinson 1936, Kolichis 1979, Bradley 1987). Little nesting information is available for the Spotted Bowerbird, other than egg collection dates and the observation that a nesting parent performed vocal mimicry and a distraction display at the nest and fed its nestlings grasshoppers, moths, caterpillars and berries (Gaukrodger 1922). As no other nesting activity is recorded we considered it important to confirm the kind of parental care and to record nestling diet during this study, as the former was in doubt (Diamond 1986) and the latter is of significance to an understanding of evolution of breeding systems in bowerbirds and other birds with polygamous males and a single nesting parent (Gilliard 1969, Donaghey 1981, Beehler 1987).

Spotted Bowerbird. The nest and eggs of this study.

Plate 57 Photo: C. & D. Frith

Methods

At 1200 h on 20 September 1988, a Spotted Bowerbird nest containing two eggs was found 6.4 m high in an Emu Apple *Owenia acidula* in low open woodland dominated by acacias and eucalypts with vine thicket, c. 100 km SSE of Charters Towers, Queensland. Fifty-five hours of nestling care were observed from 22-29 October inclusive from a hide atop a timber tower 2 m from the nest. An active, but deteriorating Spotted Bowerbird bower, known to have been there for at least six years, was located 335 m from this nest. The parent bird attending the nest had a lilac nape crest, typical of bower-owning males and some females. This bird had some crown feathers missing, exposing a conspicuous patch of grey feather bases, and had sharply defined chevron-shaped marks on the pale median covert feather tips absent in most conspecifics (pers. obs.). These combined characters, and other observations (see Results), enabled us to confirm that only this individual attended the nest. Nestling meals were carried in the parent's bill. Animal foods were always clearly visible but, in the case of a few fruit meals, we could count only a minimum number per meal because of the (infrequent and unlikely) possibility that a fruit(s) in the back of the mouth was unseen. Several fruits or several different animals brought on one visit were designated a meal.

Egg and nestling measurements were taken with vernier calipers and a stopped wing rule, and weights with a 100 g Pesola balance. Nestlings were banded with Australian Bird and Bat Banding Scheme bands. Tail length was taken as the longest (=central) feather from its point of entry into the skin to its tip. Total head length (THL) was the maximum distance from bill tip to back of the skull, and the tarsus was measured from the depression in the angle of the intertarsal joint to the distal end of the tarsometatarsus.

Spotted Bowerbird. Presumed female about to feed a grasshopper stripped of its head, wings and legs to nestlings. Note the parent bird's lilac crest, dark grey patch in the crown caused by the loss of some feathers and the distinct chevron markings on the median coverts (see Introduction)

Plate 58 Photo: C. & D. Frith

Results

The nest, eggs and hatching

The nest was built into three forking branches (60-70° from horizontal and 11-15 mm in diameter), and their numerous sub-branches, well covered above and at the sides by fine-leaved foliage (partly tied back for observation, see Plate 57). It was a bulky, loose structure of twigs atop a foundation of larger sticks up to 5.4 mm in diameter and 460 mm in length. Total nest depth was 200 mm, maximum nest cup diameter at outer rim 170 mm, interior nest cup diameter 135 mm and egg cup depth 42 mm. The nest egg cup was a sparse, flimsy, shallow bowl of naturally curved, supple twiglets of c. 1-1.5 mm diameter and up to c. 290 mm long atop and within the dishevelled stick foundation. A few foundation sticks extended up to c. 90 mm above, and outwards as far as c. 210-250 mm beyond, the nest rim. The nest was easily seen through from below.

The eggs measured 35.8 x 25.1 and 35.8 x 24.6 mm and were examined daily until 1730 h on 8 October. At 0700 h on 9 October the parent would not leave the nest, despite mild attempts to disturb it, but at 1545 h the nest was examined in the bird's absence and contained one egg and a hatchling covered in long, dense, fluffy, grey down. At 1100 h on 12 October two grey, down-covered nestlings with conspicuous, orange-yellow gaping mouths were present.

Parental care, nestling diet and nest defence

We time-budgetted 55 hours of parent attentiveness from 22-29 October inclusive. Watch periods averaged 3 h 40 min, seven a.m. watches starting from 0600-0700 h and eight p.m. watches starting from 1400-1530. No brooding was observed, but at 1446 h on 24 October the panting parent crouched over the nestlings with slightly open raised wings for 37 mins 31 secs (21% of watch), apparently to shade them from direct sunlight during this hot afternoon (34°C at 1300 h). This shading activity reduced nest visits to 4 per hour, and time feeding young to 6.2%, of this 3 h watch.

A mean of 6.7 feeding visits per hour (SD±1.58, range 4.0-9.0, n=15) were made, the mean length of each visit being 40 secs (range 1-235 secs, n=375). Feeding young occupied a mean of 6.9% (SD±1.32, range 5.5-10.6%, n=15) of observation time, including time (rarely) perching on the nest after passing food to the young.

Of 375 meals delivered by the parent 359 could be identified as comprising either animal or fruit; the rest were unidentifiable. Of the 359 identified meals, 213 (59%) consisted of animal and 146 (41%) of fruit. Of 213 animal meals, 122 (58%) were grasshoppers, Acridoidea, or crickets, Grylloidea (of which 24 were large grasshoppers stripped of their wings, legs and often, head, and 1 was a mole cricket). Fifty-one animal meals (24%) were of immobile soft, white, arthropod larvae, pupae or egg cases obtained from higher *Eucalyptus* and *Acacia* foliage close to the nest. Of other animal meals 8 were of mantids, Mantodea, 7 were katydids, Tettigonioidea, 3 were stick insects, Phasmatodea, 13 were unclassified small insects, 1 was a medium-sized beetle, 3 were caterpillars, 2 were ?slugs/worms, 2 were spiders and 1 was of a small skink.

Of the 146 fruit meals, 84 (57%) were of the Currant Bush *Carissa lanceolata*, 20 (14%) of the small perennial *Enchylaena tomentosa*, 6 (4%) of the tree *Acacia salicina* var. *varians* and 22 (15%) of blue-blackish, larger, succulent fruits, almost certainly of the Sandalwood *Santalum lanceolatum*, a species common in the general area but not observed in fruit near the nest. It was clear from departure flights and periods of absence, however, that the parent was travelling further for this latter food than for others. Fourteen fruit meals were unidentified, but we believe none of these were figs *Ficus* spp. because (a) we were looking for them and (b) fig plants were not in the nest area (see Discussion) where the vast majority of meals was obtained.

Currant Bush meals involved a minimum (see Methods) of 230 fruits, thus the mean number of fruits per meal was 2.7. The mean number of fruits per *Enchylaena tomentosa* meal was 3.5, of *Acacia salicina* meals 2.3 fruits, and of the probable Sandalwood fruits 1.2 per meal.

The parent bird produced a low, soft, repeated *grrk* note to stimulate nestlings to beg. No food was regurgitated to the young, all being carried in the bill and mouth. Nestling faeces were eaten by the parent, as were those of the perching fledglings on 31 October. During 71 (19%) of 375 foraging forays and feeding visits, the parent bird was in our view throughout and was thereby confirmed as the same individual. The parent was visible 18.5% of its time away from the nest, whilst perching or foraging elsewhere in the nest tree or in adjacent areas. These observations gave the clear impression that the parent rarely foraged more than 150-250 m from the nest.

During one nest inspection the parent vocally mimicked Whistling Kite *Haliastur sphenurus* and Blue-winged Kookaburra *Dacelo leachii* calls and, in similar circumstances the next day, also gave what sounded like a horse neigh.

The parent vigorously chased a Noisy Friarbird *Philemon corniculatus* from the nest tree and another from adjacent trees. Whilst hopping toward its nest the parent

Spotted Bowerbird. Presumed female feeding her older, 17 day-old, nestling.
Plate 59 Photo: C. & D. Frith

once heard and saw a Blue-winged Kookaburra perched c. 40 m away, froze until the kookaburra flew off five minutes later, and then gave soft perfect mimicry of a kookaburra call before feeding its nestlings.

The parent once returned with food to find an uncrested conspecific perching in the nest tree which it chased before perching above the nest, 3 m from the intruder, and mimicking Blue-winged Kookaburra and Whistling Kite calls. It then chased the intruder from perch to perch whilst giving odd whirring and clicking notes and raising and lowering its sleeked body on flexing legs, and occasionally flicking wings, until the visitor left.

At 0717 h on 28 October the parent fed its nestlings and then flew rapidly to perch c. 35 m away and 2 m high in a small tree, from which an uncrested conspecific flushed to the ground below and performed a strutting display over a 2 m diameter area with slightly drooped wings and open bill for c. 30 seconds. The parent flew at and flushed the displaying, presumed young male, bird and gave scolding notes and vocal mimicry until chasing the visitor off.

Nestling growth and nestling period

Measurements of nestlings when first measured on 23 October (when the 1st hatched was c. 15 days old) were: weight 73.1 & 68.7 g; wing 82 & 70 mm; tarsus 35.5 & 33.5 mm; THL 42.4 & 40.6 mm; tail 11.6 & 7.5 mm in pin. At this stage their irises were dark brown, bills blackish, gapes pinkish-yellow, legs grey-olive and skin dark purplish-grey. Their heads were still fluffy with grey down, but breast, abdomen, back, rump and lesser wing-covert feathers were well out of pin. On 26 October the two nestlings' measurements, in the above order, were 79.9 & 75.2 g, 94 & 84, 37.9 & 36.9, 44.1 & 42.0 mm, respectively. Their central tail-feather lengths were 20.4 &

14.8 mm, of which 7.0 & 5.1 mm respectively were out of pin. To avoid premature fledging, nestlings were not subsequently handled. Plate 59 shows the nestlings on 25 October, when the larger was 17 days old.

At 1700 h on 29 October the smaller nestling was in the nest and the larger on the nest rim, but at 1750 h the larger was perched 60 cm below the nest, where the parent fed it. At 0600 h next day both young, now with deep pink gapes, were perched 4 m from the nest, and then moved about together and in loose association within 100 m of the nest until 0900 h on 30 October when our observation ended.

Discussion

Nest, eggs, nestlings and nestling period

The nest and eggs studied were similar to those previously described for the species, although 'our' nest was deeper and smaller in overall diameter (Gilliard 1969, Cooper & Forshaw 1977). Jackson (1912) listed 17 other tree species in which this bird nests.

At 1730 h on 8 October the nest contained two eggs. Assuming the parent's refusal to leave the nest at 0700 h on 9 October (see Results) was because the first egg had hatched (confirmed hatched at 1545 h) and as the older nestling fledged between 1700 and 1750 h on 29 October, we calculate the nestling period for this young to be 20 days 17 h and 10 mins ± 7 h 10 mins. This compares with approximate nestling periods of 20 days 8 h 30 mins ± 10 h 30 mins for the Great Bowerbird *C. nuchalis* (Frith & Frith 1990), 22 days for the Fawn-breasted Bowerbird *C. cerviniventris* (Menzies 1976) and c. 19 (Hyem 1968, Pratt 1974, Vellenga 1980) and 20 days 12 h ± 12 h (Donaghey 1981) for the Satin Bowerbird *Ptilonorhynchus violaceus*.

Hatching time of the second egg was not determined because there were no 10-11 October observations, but that it possibly hatched at least a day after the first egg (see below) is noteworthy in view of this situation in the Satin Bowerbird (Marchant 1980), Great Bowerbird (Frith & Frith 1990) and Golden Bowerbird *Prionodura newtoniana* (pers. obs.). The Green Catbird *Ailuroedus crassirostris* (Donaghey 1981) and the Spotted Catbird *A. melanotis* (pers. obs.) also lay eggs on alternate days. Observations of clutch laying by bowerbirds are needed to see how widespread long laying intervals are within the family.

In having dense, long, fluffy, grey down the hatchlings were typical of bowerbirds (Frith & Frith 1989, 1990). Nestlings were examined twice (see Results), the smaller being 6% lighter, and its wing length 15 and then 11% shorter, than that of its sibling. These figures could indicate asynchronous hatching of the brood (see Frith & Frith 1989), although the differences between these siblings are not as great as those found between two Great Bowerbird nestlings (Frith & Frith 1990).

Parental care, nestling diet and nest defence

After three weeks' photography at a Spotted Bowerbird nest with nestlings, Gaukrodger (1922) was convinced one parent attended and that it was female. We could frequently confirm uniparental nest attendance and, in view of knowledge of other, sexually dimorphic, uniparental bowerbirds (Bell 1960, Vellenga 1980, Donaghey 1981, Chaffer 1984, Threlfo 1983, pers. obs.) we too assume the parent was female.

The 6.9% of observation time spent feeding young is close to the figure of 5.8% for the same activity by a presumed female Great Bowerbird (Frith & Frith 1990). Spotted Bowerbird provisioning activity was more frequent than in the Great Bowerbird we studied, the mean number of parental nest visits per hour being 6.7 and 3.7, and the mean length of absences 8 mins 22 sec and 13 mins 31 secs, respectively. The

mean length of feeding visits was 40 secs in the Spotted and 59 secs in the Great Bowerbird. Comparative data of this kind are required for these and other bowerbirds.

Of identified nestling meals, 59% were animal and 41% fruit items, proportions similar to those (56% and 44% respectively) at the Great Bowerbird nest. Moreover, 58% of the animal meals were of grasshoppers or crickets (20% of which were stripped of wings, legs and head), the corresponding figure for the Great Bowerbird being 54% and of which almost all were stripped (Frith & Frith 1990).

Gaukrodger (1922) and Lau (in Campbell 1901) observed a Spotted Bowerbird taking insects to young and, as a result, Marshall (1954) concluded that the commencement of annual Spotted Bowerbird breeding coincides with an increase in insects after seasonal rains fall. Few non-nesting Spotted and Western Bowerbirds have been recorded eating insects (Jackson 1912, McGilp 1931, pers. obs.) but they may often do so as North (1902) found beetles in many birds, and a number of birds collected in April, May and August contained grasshoppers and spiders (Hall 1974).

That the distribution, particularly the southern limit, of the Spotted Bowerbird (previously including the Western Bowerbird) was restricted by the availability of figs, notably *Ficus platypoda*, was considered false by Davies (in Cooper & Forshaw 1977), and Storr (1986) considered the presence of birds south of the figs to be a recent phenomenon. No figs were fed to nestlings at the nest studied and, although fig trees were on the Cape River, 6.5 km E of this nest, none was seen within a radius of several kilometres of it. The Currant Bush *Carissa lanceolata*, however, was abundant in the study area and represented 57% of nestling fruit meals. In addition to this and other plants mentioned above, fruits of at least 16 additional plants are eaten by Spotted and Western Bowerbirds (Jackson 1912, Marshall 1954, Cooper & Forshaw 1977, Binsted 1977, Parker 1979, A. Griffin pers. comm.).

The nidification, provisioning, care and defence of young, vocalisations, vocal mimicry and distraction displays of the Spotted Bowerbird were similar to those of the Great, Fawn-breasted and Lauterbach's Bowerbirds (Gaukrodger 1922, Marshall 1954, Bell 1969, Peckover 1969, Gilliard 1969, Hopkins 1974, Cooper & Forshaw 1977, Frith & Frith 1989, 1990). We discuss bowerbird vocal mimicry and distraction displays elsewhere (Frith & Frith 1990) but note here that, in addition to the horse neigh-like Spotted Bowerbird call, Bradley (1987) recorded mimicry of a 'horse whinny' by the Western Bowerbird. In view of mimicry of predatory birds by these bowerbirds, Stephen Debus (in litt.) suggests that this sound could be mimicry of an Australian Hobby *Falco longipennis* display call which is reminiscent of a distant horse neigh.

Relationships of nesting female with conspecifics

Our observation of an apparently immature plumaged male Spotted Bowerbird displaying to the nesting female is an apparently rare instance of male terrestrial display directed at a female remote from a bower or display site, although Warham (1962) witnessed a bird displaying in the absence of both a bower and a female. Sharland (1964) illustrated an instance of a Great Bowerbird displaying to, and mating with, another 'in a rudimentary kind of playground which had been cleared and worn smooth round the stem of a small scrub tree'. His photograph shows the male in a crest-presentation posture (see Warham 1962, Frith & Frith 1989). Presumably these displays were performed by non bower-owning males during a less sedentary phase of life.

The nest studied was 335 m from a bower of a conspecific male, and we could at times hear calls of bird(s) at this bower from the nest (hide). We discuss the location of nests relative to bowers in this and other bowerbirds elsewhere (Frith & Frith 1989, 1990).

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