Black-eared Cuckoo; mimicry of host's juvenile plumage facilitates parasitism of Speckled Warblers

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Speckled Warblers *Pyrrholaemus sagittatus* were observed feeding a fledged juvenile Black-eared Cuckoo *Chalcites osculans* at Green Wattle Creek, near Paterson in NSW in 1994. The Black-eared Cuckoos had successfully parasitised at least three Speckled Warbler pairs. Records of Black-eared Cuckoos in the Paterson area and near-coastal areas of NSW are rare and breeding unprecedented.

Recent advances in understanding of evolutionary adaptations of cuckoos and their hosts and their interactions have provided an improved understanding of the significance of these observations made over 20 years ago. Imitation of the plumage of their hosts' juveniles is pivotal to breeding success of Australian bronze-cuckoos (*Chalcites* species). Black-eared Cuckoos have evolved a white tail tip, which mimics the plumage of their primary hosts, Speckled Warbler and Redthroat *Pyrrholaemus brunneus*, in both juvenile and adult plumage. The high success rate of the Black-eared Cuckoo in successfully deceiving multiple pairs of Speckled Warblers is attributed to the naivety of the Green Wattle Creek Speckled Warbler population, which do not normally experience the presence of Black-eared Cuckoos.

INTRODUCTION

There is considerable variation in the breeding strategies used by cuckoos. At one extreme species like the Pheasant Coucal *Centropus phasianinus* are not brood parasites, building nests, incubating eggs and raising their own young. At the other extreme many cuckoo species rely on a host species to incubate cuckoo eggs in their nests, and feed the hatched cuckoo until it is independent. Many species of migratory cuckoos depart before their juveniles are independent. The Common Cuckoo *Cuculus canorus*, which has been extensively studied in Europe, is an example (Davies 2015). As discussed below other cuckoo species, including the Australian bronze-cuckoos (*Chalcites* species), are more sophisticated brood parasites than the Common Cuckoo. Recent advances in the understanding of the interactions between parasitic cuckoos and their hosts have explained observations I made over 20 years ago on Speckled Warblers *Pyrrholaemus sagittatus* acting as brood hosts of the Black-eared Cuckoo *Chalcites osculans*, a member of the genus *Chalcites*.

OBSERVATIONS

On 29 September 1994 I observed a Speckled Warbler feeding a fledged juvenile cuckoo in dry woodland at Green Wattle Creek (32° 40' S, 151° 39' E), near Paterson NSW. Aware that the Speckled Warbler was a known primary host of the Black-eared Cuckoo, which is a rare species in the Hunter Region, I returned to the area periodically to follow breeding progress. On 15 October I saw a juvenile Horsfield's Bronze-Cuckoo *Chalcites basalis* being fed by a Superb Fairy-wren *Malurus cyaneus*. My initial reaction was that the juvenile cuckoo seen on the previous occasion was successfully soliciting food from a range of species and might have been misidentified when initially seen in September. However, I subsequently detected Speckled Warblers feeding another juvenile cuckoo nearby, and this cuckoo had a white-tail tip, which is diagnostic of Black-eared Cuckoos, a plumage feature also apparent in adult birds. During this and subsequent visits I found a total of three pairs of Speckled Warbler, which I am confident were different pairs, feeding juvenile Black-eared Cuckoos. I did not see or hear an adult Black-eared Cuckoo on any occasion.

These are the only records of Black-eared Cuckoos at Green Wattle Creek between 1993 and 2014, during which period I monitored the bird population at least monthly. Speckled Warblers were abundant at that time, but declined in subsequent years (Newman 2010 & 2014) following changes in land management involving the removal of cattle.

1994 was an exceptional year. The Hunter Region and most of eastern Australia was subject to severe drought throughout much of the year. The entire Hunter Region was affected, particularly the central and western areas (Stuart 1994).

When these observations were made I was aware of the unusual nature of this record and took field notes, which formed the basis of an unusual record report form, submitted to and accepted by the Hunter Bird Observers Club. This was a prerequisite for publication of the record in their annual bird report (Stuart 1994).

DISCUSSION

It is well known that brood hosts are tricked into rearing young cuckoos. Davies (2015) in his recent book provides an overview of studies into the interaction between *cuckoos* and their hosts. These studies have demonstrated the strategic battle between parasite and host resulting in an "arms race" in which both cuckoo and host species evolve improved trickery of hosts (by cuckoos) and defences against cuckoos (by hosts) to ensure the survival of their species.

Davies suggests that the Common Cuckoo is a relatively unsophisticated brood parasite. Brood hosts of the Common Cuckoo in the UK include the Reed Warbler *Acrocephalus scirpaceus*, Meadow Pipit *Anthus pratensis*, Redstart *Phoenicurus phoenicurus* and Dunnock *Prunella modularis*. Imitating the size and colour of the host's egg is a key feature of the Common Cuckoo's strategy to deceive the host species. The female cuckoo surreptitiously replaces one of the host's eggs before the clutch is complete. Different races of the Common Cuckoo specialise in parasitising different species and produce eggs which are the same colour as the host species (i.e. brown for Reed Warbler, green for Meadow Pipit and blue for Redstart). However, the race of Common Cuckoos parasitising Dunnocks successfully deceives their host without imitating the blue colour of the host's egg. Davies suggests that this is because the Dunnock is a relatively recent host of the Common Cuckoo and has yet to develop the ability to detect and reject cuckoo eggs, even if these are a poor imitation. In the future it is anticipated that Dunnocks will detect and reject cuckoo eggs and cuckoos parasitising Dunnocks will develop blue eggs, similar to those used to deceive Redstarts.

Davies (2015) suggests that the Australian bronze-cuckoos have developed tricks to deceive their hosts, which are more sophisticated than those employed by the Common Cuckoo in Europe. Speckled Warbler and Redthroat *Pyrrholaemus brunneus* are regular hosts of Black-eared Cuckoo, but breeding behaviour of these cuckoo-host combinations has not been extensively studied (Higgins 1999). Reports of parasitism of fairy-wrens by Black-eared Cuckoos are rare (Booker & Booker 1989). Comprehensive studies of other bronze-cuckoo species provide insights into the sophistication of interactions between cuckoo and host which are potentially relevant to the Black-eared Cuckoo. Langmore & Kilner (2010) found that Superb-Fairy Wrens did not reject eggs of Horsfield's Bronze-Cuckoo and their primary defence was to detect and reject newly hatched cuckoo chicks. Horsfield's Bronze-Cuckoo hatchlings mitigated the chance of detection by having similar pinkish skin colour and begging calls to juvenile Superb Fairy-wrens. Apparently, despite these measures, female Superb Fairy-wrens frequently detect Horsfield's Bronze-Cuckoo hatchlings and abandon their nests, although males may continue to feed the cuckoo for a day or two. In contrast, Shining Bronze-Cuckoo *Chalcites lucidus* and Little Bronze-Cuckoo *Chalcites minutillus* hatchlings have yellow and black skin, imitating the colour of their primary hosts, which are Thornbill *Acanthiza* and Gerygone *Gerygone* species respectively. To explain why Australian bronze-cuckoo hatchlings are rejected, but Common Cuckoo hatchlings are not, Davies (2015) suggests that the "arms race" in Australia is more ancient than in Europe and there has been more time to evolve sophisticated counter strategies. This proposition is consistent with DNA evidence, which suggests that Australian bronze-cuckoos have been interacting with their hosts for several million years, compared with 80,000 years for the Common Cuckoo.

Langmore & Kilner (2010) have summarised the hierarchy of host defences against cuckoos, which include cuckoo recognition and mobbing, egg rejection and chick rejection. Successful cuckoos evolve counter measures to avoid detection at each of these stages. For instance, although the male bird's calls are likely to attract attention, many species have evolved in such a way as to present a falcon-like silhouette likely to discourage mobbing. Cuckoos, especially the female, are very secretive near nests to avoid detection by host species. I did not record any adult Black-eared Cuckoos at Green Wattle Creek, which is

consistent with their adopting furtive behaviour to avoid detection by hosts.

The Black-eared Cuckoo and other bronze-cuckoo species parasitise hosts which build domed nests. Langmore (2013) has suggested that the dark interior of enclosed nests makes it difficult for host species to detect visual differences in eggs, provided that they are of a similar size. Dark egg colouration is an advantage favouring the cuckoo. Black-eared Cuckoo eggs fit this criterion. They are very similar to those of the main hosts, Redthroat and Speckled Warbler, being variously described as reddish-chocolate and chocolate-brown. Interestingly this colour is not incorporated into the egg shell and can be rubbed off with a damp finger, leaving a pale blue shell beneath (Higgins 1999).

Consequently, the most important line of deception employed by bronze-cuckoos lies in chick mimicry, involving hatchlings which visually resemble and sound like those of host species (Langmore 2013). Conversely, the primary defence of the hosts of bronze-cuckoos is to be able to detect chick mimicry. In the case of the Black-eared Cuckoo my observations indicate that the mimicry extends to the evolution of a white tip to the tail, a characteristic of both primary host species, Speckled Warbler and Redthroat. This feature is missing from the juveniles of the other bronze-cuckoo species, which allowed me to differentiate between the fledged young of Horsfield's Bronze-Cuckoo and Black-eared Cuckoo breeding in close proximity at Green Wattle Creek. Recognition and rejection of cuckoo hatchlings has been shown to be learned behaviour with successful parasitisation higher in Superb Fairy-wren populations not previously exploited by cuckoos, compared with those previously parasitised (Langmore *et al*. 2012).

Successful brood parasites must not only have effective strategies for cheating on their hosts, but also avoid competition with other cuckoos. Territorial behaviour minimises the risk of multiple eggs of the same cuckoo species being deposited in a host nest, or even a cuckoo's egg being substituted by the egg of a second cuckoo female. In the present instance involving an out of range presumed single pair of Black-eared Cuckoos breeding at Green Wattle Creek, intra-species competition was not a difficulty, but inter-species competition was a possibility. At Green Wattle Creek four other cuckoo species occur, which predominantly exploit domed nests. Langmore (2013) provides insights into strategies, which minimise competition between these species by using different hosts. In the case of the competing cuckoo species at Green Wattle Creek: Horsfield's Bronze-Cuckoos primarily select Fairy-wren hosts, while the Shining Bronze-Cuckoo usually parasitises thornbill species and Fan-tailed Cuckoos *Cacomantis flabelliformis* and Brush Cuckoos *Cacomantis variolosus* also favour host species which build domed nests, mainly thornbills and scrub-wrens (Higgins 1999). Hence although Speckled Warblers have been known to host Fan-tailed Cuckoos (Higgins 1999), they are not normally parasitised by any of these cuckoo species.

The very high success rate with which the Black-eared Cuckoo parasitised Speckled Warblers at Green Wattle Creek warrants comment. In October 1994 I recollect thinking that every Speckled Warbler found seemed to be feeding a juvenile Black-eared Cuckoo. As mentioned previously Langmore *et al.* (2012) have suggested that cuckoos are more successful when dealing with naïve hosts, and that they may strategically change their territories between years to avoid decreased breeding success associated with experienced hosts. The Speckled Warbler population at Green Wattle Creek would fall in the naïve category with respect to Black-eared Cuckoos, which are extremely rare in the Paterson area.

CONCLUSIONS

When these observations were first made over twenty years ago, I used the white tip to the tail of recently fledged cuckoos as a diagnostic identification tool. I appreciated the fact that this plumage feature involved mimicry of the Black-eared Cuckoo's two primary hosts, Speckled Warbler and Redthroat. It was also apparent that this adaptation to mimic the appearance of their host's juveniles had resulted in the evolution of Black-eared Cuckoos with an adult plumage characteristic, namely the white tip to the tail, which is characteristic of their adult hosts and not present in the other species of Australian bronze-cuckoo.

Since my observations in 1994 there have been significant advances in understanding the behavioural adaptations and interactions between cuckoos and their hosts, both overseas (Davies 2015) and in Australia (Langmore 2010 & 2013). Davies has suggested the possibility that the Australian bronze-cuckoos occurred early in evolutionary history and as a consequence the

"arms race" between host and parasite is more advanced than in the Common Cuckoo of Europe. As a consequence bronze-cuckoos have evolved sophisticated adaptations to prevent their hosts from detecting and rejecting hatched cuckoos. Langmore *et al.* have demonstrated that learning by experience is important with respect to detection of cuckoos and preventing parasitism. Also the hosts of bronze-cuckoos may be forced to rely on the detection of hatched cuckoos, because of the difficulty of detecting and rejecting cuckoo eggs in the darkness of their domed nest structures. These developments provide a more complete understanding of my 1994 observations of arguably the least studied of the bronze-cuckoos. The Black-eared Cuckoo may well be the most sophisticated mimic of the genus, having adapted to imitate a feature of its host's juvenile and adult plumage, namely the white tail tip.

The fact that a number of pairs of Speckled Warblers were successfully parasitised by the Black-eared Cuckoos at Green Wattle Creek is attributed to the fact that Black-eared Cuckoos seldom occur as far east in NSW as the Paterson area. This unusual occurrence at Green Wattle Creek was probably a consequence of drought conditions, which were prevalent inland at that time.

REFERENCES

Brooker, M.G. and Brooker, L.C. (1989). Cuckoo hosts in Australia. *Australian Zoological Reviews* **2**: 1-67.

Davies, N. (2015). 'Cuckoo - Cheating by Nature'. (Bloomsbury Publishing Plc.: London.)

Higgins, P.J. (Ed.) (1999). 'Handbook of Australian, New Zealand and Antarctic Birds Volume 4: Parrots to Dollarbird'. (Oxford University Press: Melbourne.)

Langmore, N.E. and Kilner, R.M. (2010). The coevolutionary arms race between Horsfield's Bronze-Cuckoos and Superb Fairy-wrens. *Emu* **110**: 32-38.

Langmore, N.E., Feeney, W.E., Crowe-Riddell, H., Luan, H., Louwrens, K.M. and Cockburn, A. (2012). Learned recognition of brood parasitic cuckoos in the superb fairy-wren *Malurus cyaneus*. *Behavioral Ecology* **23**(4): 799-805.

Langmore, N.E. (2013). Fairy-wrens as a model system for studying cuckoo-host coevolution. *Emu* **113**: 302-308.

Newman, M. (2009). Birds of Green Wattle Creek – monthly surveys 1996-2009. *The Whistler* **3**: 14-29.

Newman, M. (2010). Impacts on Speckled Warbler abundance in the Paterson area of NSW. *The Whistler* **4**: 54-58.

Newman, M. (2014). Response of eight bird species to woodland rehabilitation at Green Wattle Creek in the Hunter Region of New South Wales. *Australian Field Ornithology* **31**: 194-207.

Stuart, A. (Ed.) (1994). Hunter Region Annual Bird Report **2**: 26. (Hunter Bird Observers Club Inc.: New Lambton.)