

Evidence for Giant Cowbird *Molothrus oryzivorus* brood-parasitism of Turquoise Jays *Cyanolyca turcosa* in north-west Ecuador, and how this alters our understanding of cowbird brood parasitism

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Sortee las observaciones del valle de Tandayapa, Ecuador, proporciona la primera evidencia de parasitismo exitoso de cría de corvids (es decir, los Urraca Turquesa *Cyanolyca turcosa*) por Vaquero Gigante *Molothrus oryzivorus*. Estos datos sugieren que en el extremo de su gama de altitudinal Vaquero Gigante es más flexible en su elección de anfitrión de cría que pensó previamente.

Giant Cowbirds *Molothrus oryzivorus* are abundant in eastern Ecuador, but less common in the west¹² and are occasionally observed as high as 2,000 m¹². The species is considered a brood-host specialist: it parasitises seven cacique *Cacicus* and oropendola *Psarocolius* species^{3,5,14} and has never, to our knowledge, parasitised any corvid. In contrast, Ortega¹⁰ considered three other parasitic cowbirds *Molothrus aeneus*, *M. bonariensis* and *M. ater* brood-host generalists. Brown-headed Cowbird *Molothrus ater* is known to have parasitised 226 host species^{3,10}. Thus, when two Turquoise Jays *Cyanolyca turcosa* were observed at Bellavista Lodge, on the old Nono–Mindó Road, in western Ecuador, at 2,250 m, feeding two highly vocal (audible up to 100 m away) and aggressive Giant Cowbird fledglings in late May 2005, by MW, the initial identification was regarded as tentative. Subsequent discussion with AV, PS (both guides at Bellavista Lodge) and TN confirmed the identification. These observations are significant. This is the first documented evidence for Giant Cowbird parasitism of corvids. It is also the first documented evidence for multiple Giant Cowbird young being reared by one set of brood-parents.

Study area

Bellavista Lodge is in the Tandayapa Valley, which area varies between 1,400 m and lower montane (subtropical) forest, and 2,400 m and upper montane (temperate) forest², and is c.50 km west of Quito. Extensive deforestation in the last 60 years has created a patchwork of active and abandoned cattle pastures, landslides, stands of bamboo (*Chusquea* sp.) and second-growth forest adjacent to the old Nono–Mindó road¹⁸. Locally disturbed primary forest is found away from the road, particularly above 2,300 m within the valley. Since the completion of the Calacali Road in 1981, connecting Quito with Esmeraldas, the valley has undergone extensive, largely unassisted reforestation.

Both Turquoise and Beautiful Jays *Cyanolyca pulchra* occur in the valley, though the former



Figure 1. Turquoise Jays *Cyanolyca turcosa* feeding Giant Cowbird *Molothrus oryzivorus* fledgling: (a) fledgling approaching adult jay on the covered walkway; (b) fledgling receiving food from adult jay; (c) the second jay replaces the adult in (b) and feeds the same fledgling.

species is far commoner and easy to locate, possibly because it is more tolerant of rather degraded forest⁶, and typically moves around the valley in noisy flocks of 2–6 birds. Giant Cowbirds are present in the lower valley, typically below 1,700 m, but are not common, and rarely observed above 2,000 m. Both Hilty & Brown⁶ and Ridgely & Greenfield¹² note that Giant Cowbirds are usually silent.

Observations

AV and PS first observed two Turquoise Jays feeding two young black nestlings in a large, rather exposed nest on 7–15 February 2005. No Turquoise Jay young were observed with the cowbird young. They first observed the fledglings out of the nest on 15–19 March.

Between 28 May and 10 June, observations of the jays and the two young cowbirds were recorded on a daily basis and the pair and the young were typically observed for 2–4 hours each day. Each day, between 06h30–09h00, the two Giant Cowbird young were observed begging for food, which consisted mostly of moths and katydids attracted by artificial lights and taken by the adult Turquoise Jays from beneath the lodge's windows. Whilst the jays foraged the cowbirds were relatively quiet and stayed close to each other, usually 1–2 m apart and 10–20 m from the adult jays. As soon as the jays found food, both cowbirds would fly down to them calling loudly. Landing 1–2 m from the jays, they would crouch low and hop sideways closer to the jays calling loudly (Fig. 1). In late morning and afternoon the jays continued to concentrate their foraging efforts around the lodge. In particular, they were successful at finding large moths and other insects in the thatch of the lodge's roof and covered walkway connecting the sleeping quarters with the kitchen. By 10 June the jays and cowbirds were observed less frequently but BU captured several images of the young cowbirds being fed.

Discussion

This single incident of brood-parasitism by Giant Cowbirds of Turquoise Jays might be an isolated occurrence, but equally could be of broad significance if it does indicate that Giant Cowbirds are expanding their base of hosts. Our current understanding of host/brood parasite dynamics within Old World cuckoos and New World cowbirds is contentious. Extensive field work and DNA analysis of Old World cuckoos clearly indicate that Old World cuckoos evolve toward greater brood-host specialisation³. In fact, there appears to be four stages leading to brood-host specialisation³.

In stage 1, there is no host rejection of eggs and no cuckoo egg mimicry³; as a result many brood-hosts are possible. This suggests that most hosts are new victims and have not evolved defences³.

This stage appears to explain the situation observed today in the USA and Caribbean of Brown-headed and Shiny Cowbird parasitism. In stage 2, hosts begin to reject eggs whilst cuckoos begin to concentrate on fewer hosts that do not reject eggs, yet egg mimicry still does not occur³. This stage has been clearly illustrated in experiments within the distribution of Common Cuckoo *Cuculus canorus* where many non-host species are strong egg rejectors³. This suggests previous host–brood parasite interaction, with the hosts evolving the means to discriminate between their own eggs and those of the brood-parasite. In stage 3, egg mimicry occurs with egg acceptance amongst brood hosts, and cuckoo gentes (i.e., races) develop³. Gentes are host-specific races that develop in large areas of identical contiguous habitat¹⁵ due to intense egg rejection and subsequent development of egg mimicry. Because egg mimicry is an inherited trait and not flexible, cuckoo brood parasitism is only successful where cuckoo eggs accurately mimic host eggs. This stage also appears to be the stage that Giant Cowbirds have reached, but Giant Cowbird gens have not been identified yet⁵. Finally in stage 4, brood-hosts evolve greater egg selectivity and reject most mimic eggs, and parasitism rates decline to very low levels, for instance parasitism rates of Eurasian Reed Warbler *Acrocephalus scirpaceus* by Common Cuckoo are now only 5% in southern England^{3,9,11}. Brood specialisation appears then to be an outcome of a cuckoo–host ‘arms race’^{1,3,4,13}.

In the New World, brood parasitism has evolved in several groups but the best known are the cowbirds, having evolved from other Icterids⁸. The oldest cowbird species, c.2.8–3.8 million years old—Screaming Cowbird *Molothrus rufoaxillaris*—is an extreme brood specialist with only a single host, Bay-winged Cowbird *Molothrus badius*^{3,8}. Hudson⁷ found that Screaming Cowbird did not just mimic egg colour but also that the nestling and fledgling were identical. The second oldest member—Giant Cowbird—parasitises just seven hosts⁸ and mimics host eggs⁵. Moreover, both caciques and oropendolas vigorously defend nests from Giant Cowbirds^{4,13,17} and reject eggs¹⁷. In contrast, Brown-headed Cowbird has 226 host species and is the most recent evolutionary branch⁸; it is considered to have evolved c.1 million BP³. Old World cuckoos evolved 65–144 MYA³, suggesting that older brood-parasite species have fought a very long ‘arms race’ with their brood-hosts and have been forced to specialise as their brood-hosts evolved better defences. This might indirectly explain why both Brown-headed and Shiny Cowbirds are such host generalists, because they have both recently evolved and expanded their ranges, enabling them to continue to parasitise brood-hosts with no prior exposure to parasitism and hence no evolved

defences. Brown-headed Cowbird has expanded its range within the continental USA as deforestation has fragmented the forest landscape³. If this hypothesis is correct, i.e. that range expansion also necessitates host generalisation, this might explain why the example of parasitism identified within this paper occurred. Since the 1960s more than 97% of forest on the western slope of the Ecuadorian Andes has been cut¹⁶. Moreover, this event occurred at the upper limit of the Giant Cowbird's range, at 2,050 m where its principal western slope brood-host, Russet-backed Oropendola *Psarocolius angustifrons*, is rare. It also suggests that Turquoise Jays have not been exposed to brood-parasitism in the recent past.

Conclusion

Our data suggest that Giant Cowbirds are able to adapt to new environments either ahead of the expansion of their traditional brood-hosts or at the limit of their traditional host range where few hosts occur, and parasitise new hosts not previously exposed to brood-parasitism. Hence, though egg colour is fixed in the short-term through evolutionary mimicry, behavioural brood parasitism is more flexible. Moreover, because of continuing deforestation, this example is unlikely to be the last example of Giant Cowbird parasitism of corvids in western Ecuador.

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