ABSTRACT Species with highly complex and distinct displays are expected to have strong reproductive isolation and are unlikely candidates to produce hybrids 1. Bowerbirds have among the most complex sexual displays, yet contrary to expectations, there have been anecdotal reports of ongoing hybridization between great (Chlamydera nuchalis) and spotted bowerbirds (Chlamydera maculata), which have distinctive phenotypes 2. Here we report finding a population with a high frequency of hybridization between these species and provide evidence of hybridization from plumage, morphology, mtDNA and behavior. We suggest that reproductive isolation may be particularly susceptible to break-down under conditions where males can learn display from individuals other than their parent. Evidence showing that individuals of each species attend heterospecific bower and receive courtship, and that some hybrids and birds with parental-species phenotypes use displays of both species supports the hypothesis that bowerbird displays are learned 3. It also suggests that cross-species cultural exchange occurs and may account for the occurrence of hybrids even between species with complex and highly differentiated display. The high level of hybridization detected does not support a reinforcement model of display divergence in bowerbirds 4.

METHODS

STUDY SITES

• SYMPATRY: ~120 km long (N-S) by 40 km wide area in NW Queensland, AUS. C. nuchalis phenotype is more common in the north and C. maculata in the south.

• ALLOPATRY: 4 locations for C. maculata in central and western QLD and 1 location for C. nuchalis in NE QLD.

DATA COLLECTED

• MORPHOMETRY: Weight, wing length, tarsus length, bill length (Table 1).

• PLUMAGE: For each bird, we combined the scores of 5 species-diagnostic plumage areas 5 (Table 1).

• MOLECULAR: mtDNA (cytB) sequence.

• DISPLAY: Automated video cameras recorded behavioral display at multiple bowers per location for up to 1 month 6. We also collected data on bower displays.

ANALYSES

• We performed a principal components analysis on morphological and plumage characters. We plotted the first two components for captured birds of each parent-species in allopatry and birds of the sympatric population (Figure 1). We classified individuals as hybrid based on: (1) phenotype that was intermediate to parent-species, or (2) phenotype-mtDNA genotype mismatch.

• Birds on video (not captured) were classified based on visual assessment of plumage and size. These birds were used only for analysis of display transfer.

• We scored displays of birds in sympathy for elements unique to parent-species in allopatry, (14 C. maculata elements, 8 C. nuchalis elements) (Table 2). Display types scored include “dancing”, display distance,bower materials and size.

RESULTS

HYBRIDIZATION

• 8 confirmed hybrids out of 25 birds captured in sympathy (see Fig. 1).

• Bidirectional hybridization (2 hybrids have mtDNA typical of C. maculata; other 6 have C. nuchalis mtDNA).

CULTURAL TRANSFER

• 2 putative C. maculata bower-owners (classified by phenotype and mtDNA) performed displays of both species.

• One hybrid bower-owner in the northern region, where C. nuchalis is more common, used only C. nuchalis displays. In the southern region, where C. maculata is more common, 1 hybrid bower-owner used only C. maculata displays and one other bower owning hybrid used displays of both species. All hybrid bower-owners were classified by phenotype and mtDNA.

HETERO SPECIFIC COURTSHIP

• Putative C. nuchalis females (not-captured) observed receiving courtship from a C. maculata male (1 obs.) and a hybrid male (3 obs.). Males were classified by phenotype and mtDNA.

DATA SUMMARY

• This is the first confirmed hybrid zone between any pair of bowerbird species.

• Bi-directional hybridization shows females of both species mate with heterospecifics.

• Some putative C. maculata males used C. nuchalis-type display elements which suggests that interspecific cultural transfer of male display has occurred.

• Hybrid bower-owners use displays of locally common parent-species suggesting that display acquisition is strongly influenced by which display model males are more likely to encounter.

• Heterospecific courtship suggests that hybridization is the result of female choice, and not forced copulation. Females may hybridize with males that have learned to produce heterospecific displays.

• High frequency of hybridization suggests that display divergence between these species is not the result of reinforcement.

Acknowledgements

Funding provided by a National Science Foundation grant to G.B. and Univ of Md fellowship to B.C. Thanks to local residents for granting property access and help finding bowers, Australian Bird and Bat banding Scheme, and QLD National Parks and Wildlife Service. Special thanks to P. Zavaresi and R. Fleischer for assistance with molecular work. Thanks also to J. Keagy, C. Long, S. Reynolds, J-F. Savard

References


Images:

1. Principle components plot for allopatric and sympatric Spotted Bird type 46.7 (0.99) 16.6 (0.58) Number of birds of each type that performed only spotted Only Great 12 (4) 190 (8.8) 6-7 24(12) 7(2) 27-30 18.8 (0.77) Plumage

2. Table 1. Means (SD) of phenotypic characters used in PCA. Range is given for plumage scores. Independent t-tests show highly significant differences between species in all trait values (p<.00001).

3. C. nuchalis (n=17) C.maculata (n=13) Parent species -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 -5 -4 -3 -2 -1 0 1 2 3 4 5

4. Figures 1, 2, and 3 give an example of the display divergence between these species.