

Mismatch between high UV plumage reflectance and female preference for blue in satin bowerbirds

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Introduction

Colorful plumage displays are among the most striking examples of sexually selected traits^{1,2} and these displays are highly elaborated in lekking bird species^{3,4}. The color of male display traits is important to the mate choice of many polygynous bird species⁵⁻⁷ but not in others that show very striking sexual dimorphism⁸⁻¹⁰. Bowerbirds have multiple potentially informative visual signals involving both plumage and bower decoration displays, and while decorations are known to be an important component of mate choice in many species, the role of plumage in mate choice remains to be resolved. Here we test how spectral reflection by plumage affects mate choice in the satin bowerbird (*Ptilonorhynchus violaceus*) by addressing two questions:

- 1) Is there a relationship between plumage coloration and male mating success?
- 2) If so, is there a correspondence between the peak of plumage reflectance and the wavelengths that are important in predicting male mating success?

Methods

• We recorded activity at bowers across mating seasons using an automated video monitoring system¹¹. The number of copulations from video tapes provided male mating success which is an accurate measure of genetic reproduction¹².

• We measured plumage reflectance of adult males in 2003 (fig. 1) and 2005 using a S2000 spectrometer and PX-2 pulsed xenon light source (Ocean Optics, Dunedin, Florida, USA). The measurements for each individual were averaged across body regions¹³.

• We calculated a chroma index for the blue wavelengths ($R_{405-480nm}/R_{300-700nm}$) as well as for UV wavelengths ($R_{300-400nm}/R_{300-700nm}$) for each male.

• To investigate whether variation in plumage reflectance between males at certain wavelengths is associated with mating success, we graphed correlation coefficients of mating success and brightness standardized plumage reflectance for 20 nm intervals of the avian visible spectrum⁷ (fig. 1).

• Evidence from many species has shown that chroma is positively related to male mating success (e.g. in birds^{7,14}, fish^{15,16}, and lizards¹⁷). This leads to the *a priori* prediction of a positive relationship between male mating success and plumage saturation and supports the use of one-sided tests of hypotheses¹⁸.

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Results

1) There is a significant positive relationship between male mating success and blue chroma in 2003 and in the combined data (table 1). No relationship was found between mating success and UV chroma.

2) Satin bowerbird peak plumage reflectance is in the UV, but correlation coefficients between male mating success and 20 nm spectral intervals are highest and statistically significant in the blue wavelengths (fig. 1) and this pattern is consistent in both years.



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	2003 MS	2005 MS	Both Years Combined
UV Chroma (320-400nm)	$r_s = 0.157$ $p = 0.304$ $n = 13$	$r_s = -0.123$ $p = 0.359$ $n = 11$	$r_s = -0.148$ $p = 0.273$ $n = 19$
Blue Chroma (405-480nm)	$r_s = 0.552$ $p = 0.025$ $n = 13$	$r_s = 0.301$ $p = 0.184$ $n = 11$	$r_s = 0.390$ $p = 0.049$ $n = 19$

Table 1
Spearman rank order correlations between male mating success and blue and UV plumage chroma.

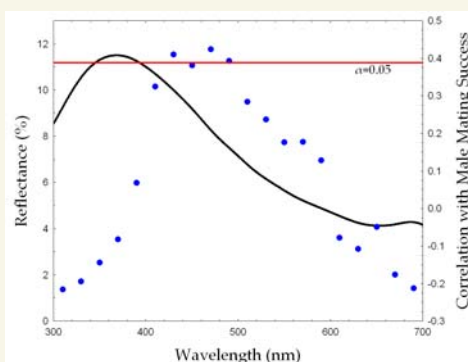


Figure 1

~ Mean reflectance spectrum of 13 bower holding adult males in 2003.

- Spearman rank order correlation coefficients between male mating success and brightness standardized plumage reflectance for 20 nm intervals. Years combined (n=19 males). Horizontal red line indicates the critical value of 0.05.

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Discussion

• In satin bowerbirds there is a mismatch between male UV plumage reflectance and female preference for blue plumage coloration in mate choice.

• This result disputes a previous study of satin bowerbirds that indirectly suggested an important role for UV using correlates of male mating success¹³.

• Our finding that the chroma of a low reflectance color (ca. 8-12%) is important in predicting male mating success suggests that relatively low reflectance plumage coloration can be biologically important^{19,20}, but see 21,22.

• Illumination on the forest floor generally contains low amounts of UV light^{23,24} and this may affect the displays of ground courting species²⁵⁻²⁷ such as satin bowerbirds. Another study showing that males do not discriminate between UV blocked and UV reflective blue decorations²⁸ is consistent with this hypothesis.

• The mismatch between peak plumage reflectance and female preference suggests that the presence of UV reflection in plumage, even as the most reflective component, does not necessarily lead to the conclusion that UV is used in display, as has been suggested in other studies^{29,30}.

