

Pryke, S. R. 2003. Sexual selection and plumage ornamentation in widowbirds

Department of Zoology, Göteborg University, Box 463, SE 405 30 Göteborg, Sweden.

Abstract – Sexual signals comprise a bewildering diversity of peculiar forms, elaborate displays and dazzling colours among birds. However, despite much attention, the diversity and adaptive significance of avian ornamentation, among as well as within species, remains largely unexplained. In the polygynous African widowbirds (*Euplectes* spp), male nuptial plumage frequently comprises two extravagant signal traits; (1) ontogenetically and aerodynamically costly graduated tails, and (2) carotenoid-based yellow or red colouration likely revealing nutritional status and health. The potential adaptive and non-adaptive functions of long widowbird tails have received attention, but the signal functions of their conspicuous plumage colours have not previously been studied. Furthermore, the coexistence of multiple costly ornaments, such as those displayed by many male widowbirds, are predicted to be evolutionarily unstable. Here I explore the mechanisms of sexual selection favouring tail elongation and red plumage patches in two contrasting *Euplectes* species, the long tailed red-collared (*E. ardens*) and the short tailed red-shouldered (*E. axillaris*) widowbirds.

From a variety of morphological, behavioural and territory variables, multivariate selection analyses singled out tail length as the main cue for female choice in red-collared widowbirds. The preference for long tails was corroborated by an experiment, which in addition suggested that tail elongation imposes larger costs (e.g. aerodynamic, physiological and energetic) on longer-tailed males. The strong female preference for long and 'supernormal' tails in the short-tailed red-shouldered widowbird further suggests that directional female choice is the major selective force favouring tail elaboration, potentially even predating the evolution of long tails in widowbirds.

Contrary to recent studies on carotenoid-based plumage ornaments, the sexually dimorphic and variable carotenoid colour patches of widowbirds are ignored in mate choice, and instead appear to function as status signals in male contests. Territorial competition is intense, with a large population of non-territorial floater males that rapidly fill vacant territories. In experiments with red-collared widowbirds, males given redder and/or larger collar patches dominated rivals in staged dyadic contests, defended larger territories, and received fewer aggressive intrusions and interactions. Similarly, resident male red-shouldered widowbirds with larger and (to a lesser extent in this species) redder epaulettes out-competed floating males with smaller epaulettes both in the field and in captivity.

The coexistence of multiple costly signals (long tails and red badges) in widowbirds is likely a result of disparate selection pressures from different receivers: female mates and male rivals. Males need to invest enough in the carotenoid status signal to obtain a territory, while allocating sufficient resources into growing a tail long enough to attract females. Due to costs of producing and maintaining these signals they may, however, compete in terms of sender investment. This is indicated by a phenotypic trade-off between tail length and carotenoid display in the red-collared widowbird, which may arise from allocation conflicts between the traits.

Keywords – sexual selection, plumage ornamentation, tail length, carotenoid coloration, female mate choice, male competition, condition-dependence, *Euplectes*, widowbirds