

## **Colour vision and colours in lacertids**

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### **Summary**

Lacertid lizards exhibit striking and highly variable ornamental colourations that have long attracted the attention of biologists, but recent studies have tended to downplay their potential role as communicative signals. The first aim of this thesis has been to study colour perception in lacertid lizards, including the possibility that they may be able to perceive the near ultraviolet portion of the electromagnetic spectrum (UVA). Based on this information, I conducted an in-depth study of lacertid colouration patterns, their evolution, and their role in relation to crypsis and communication. Results indicate that lacertids have a tetrachromatic colour vision system, with a cone receptor that is sensitive to UVA light. Colour perception in lacertids therefore extends over the 300–700 nm range of wavelengths. Using objective techniques for colour determination and analysis, I found that lacertid colourations are more variable and complex than the human eye reveals. Based on a phylogeny of lacertids, I used methods of character reconstruction for tracing the evolution of the main lacertid colour characters and I have proposed what was the colour pattern of the ancestral lacertid (which was formed by brown dorsal colouration, white ventral colouration and ultraviolet eyespots). Throughout their evolution, some lineages of Lacertidae acquired new chromatic characters (especially in the Euroasiatic clade Lacertini), while other lineages lost or simplified some of their colour patches (especially in the African clade Eremiadini). Spectrophotometric results on present species and historical analyses force us to rethink and reanalyse many of the conclusions arrived at in previous studies of lacertid colouration.

Conspicuous colourations of lacertids seem to fit assumptions about the design of animal signals. Namely, they contain information about individual quality and their location in the lizards' ventral and ventrolateral surfaces makes them especially detectable for their primary receivers (*i.e.*



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Adult male of *Podarcis muralis* shows a cryptic dorsal colouration that contrasts with the conspicuous lateral ultraviolet eyespots and the orange ventral parts.

conspecific lizards) and difficult to detect for most of their predators. Pigmentary and structural found on these surfaces allow the transmission of complementary information and their combined effect increases the general conspicuousness of the colour patterns.

Whereas dorsal colourations are designed by selective pressures relating to camouflage, a phylogenetic comparative analysis strongly suggests that conspicuous colourations are designed for their role as chromatic signals and are under selective forces relating to intrasexual selection, which results in a prominent sexual dichromatism in those species in which intrasexual selection is stronger.