Supplementary material

**Sexually dimorphic blue bands are intra-sexual aposematic signals in non-territorial damselflies**

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Methods and materials

We applied the receptor noise model (Vorobyev, Osorio, Bennett, Marshall, & Cuthill 1998; Misha Vorobyev & Osorio 1998) to analyse how the male blue bands and female abdominal black coloration will appear to conspecifics. Damselflies can have trichromatic (Huang, Chiou, Marshall, & Reinhard 2014) or tetrachromatic (Outomuro, Söderquist, Johansson, Ödeen, & Nordström 2017) visual systems. As we do not know the visual system of *X. erythroneurum* damselfly, we used both trichromatic and tetrachromatic system. We ran the visual modeling in pavo v. 1.0.0 (Maia, Eliason, Bitton, Doucet, & Shawkey 2013) implemented in R v. 3.4.1 (2017).

First, we calculated the quantum catch (Qi) for each photoreceptor i as follows-

Qi =

Where is the wavelength, ) is the reflectance spectra of damselfly integument or each background leaf, is the light spectrum entering the eye, and Ri is the spectrum sensitivity of the photoreceptor i. We used a standard daylight spectrum (D65) as (Wyszecki & Stiles 1982)

Then, we calculated the noise of each class photoreceptor (*e*i) as,

= .

Where *ω* is the Weber fraction assigned to each receptor and *n*i is the relative density of the receptor class *i*. We applied a Weber fraction of 0.12, which was successfully used in damselfly visual modeling (Schultz & Fincke 2013).The proportion of the photoreceptor of damselflies are not known. So we applied receptor density of another trichromat, the honey bee (1:0.471:4.412) (Defrize, Théry, & Casas 2010).

Finally, we calculated the chromatic contrast (ΔS) between the damselfly spectra and the background using the equation:

Where Δ*f*i is the log of quantum catches for receptor *i* between damselfly and the background.

Also, to calculate the achromatic contrast we used green photoreceptor like honeybee visual system and the achromatic contrast (ΔL) was calculated as:

ΔL =

For the tetrachromatic damselfly visual system we used photoreceptor sensitivities 366 nm, 480 nm, 552 nm, 640 nm ((Outomuro, Söderquist, Johansson, Ödeen, & Nordström 2017) photoreceptor density 2:2.5:2.5:1 (Armett-Kibel & Meinertzhagen 1983) and a Weber fraction 0.12 (Schultz & Fincke, 2013). We calculated the chromatic contrast using the equation:

The achromatic contrast for the tetrachromatic visual system was calculated using the same equation for trichromatic visual system.

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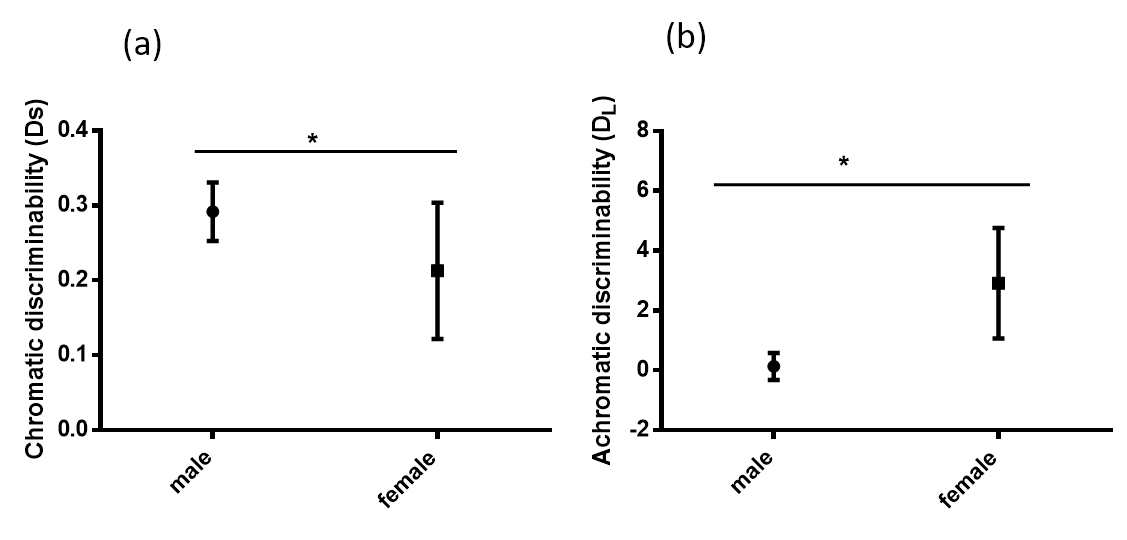
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Supplementary figure S1



Supplementary figure S1: a) Chromatic (DS) and b) Achromatic discriminability (DL) of male and female abdominal colouration (segment S8 and S9) in tetrachromatic damselfly visual system.