Temperature dependence of *Ascalaphus macaronius* electroretinogram

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Introduction. The owlfly *Ascalaphus macaronius* (Insecta: Neuroptera) is a daytime predator famous due to the unique spectral sensitivity of its dorsofrontal (DF) eye that ranges only over the UV-part of the spectrum. It is a stenoecological animal inhabiting warm uncultivated meadows that lives as adult imago only for approximately two months in the summer. Even then, *Ascalaphus* is actively hunting only under unobscured skies. Field observations, measurements of its body temperature and spectral measurements of the sky have shown that its behavior is triggered by the heat coming from direct insolation rather than by amount of UV light. Thus, electroretinography which had once offered an insight into *Ascalaphus*' unusual vision was this time used to evaluate the animal's thermal demands.

Experimental animals and methods. *Ascalaphus* adults were caught in the Karst region of Slovenia in July 2001. Animals were kept at a room temperature in individual vials and paper wraps, fed by liver and flies (*Calliphora*) and tested within two weeks after capture. Experiments were performed on intact eyes. Animals were immobilized with a mixture of bee's wax, colophony and contact paste onto a copper yoke. The temperature of the animal was controlled within a range between 12 and 42°C with a Peltier element lying underneath the preparation and monitored by a thermocouple inserted into the eye. Stimulation was provided by 150 W a xenon arc lamp, IR was cut off with cold mirrors, wavelengths were selected with an Oriel monochromator, and intensities were controlled with Melles Griot fused silica neutral density filters. Extracellular potentials were recorded by glass pippetes filled with Davenport saline. Ag/AgCl wire inserted into thorax or into the unilluminated DF eye served as a reference. Signals were amplified with Axon 401 preamp and Axon Cyberamp 320, digitized with a National Instruments NI-DAQ 1200 Lab PC, and stored in a Pentium PC running Strathclyde WinWCP software.

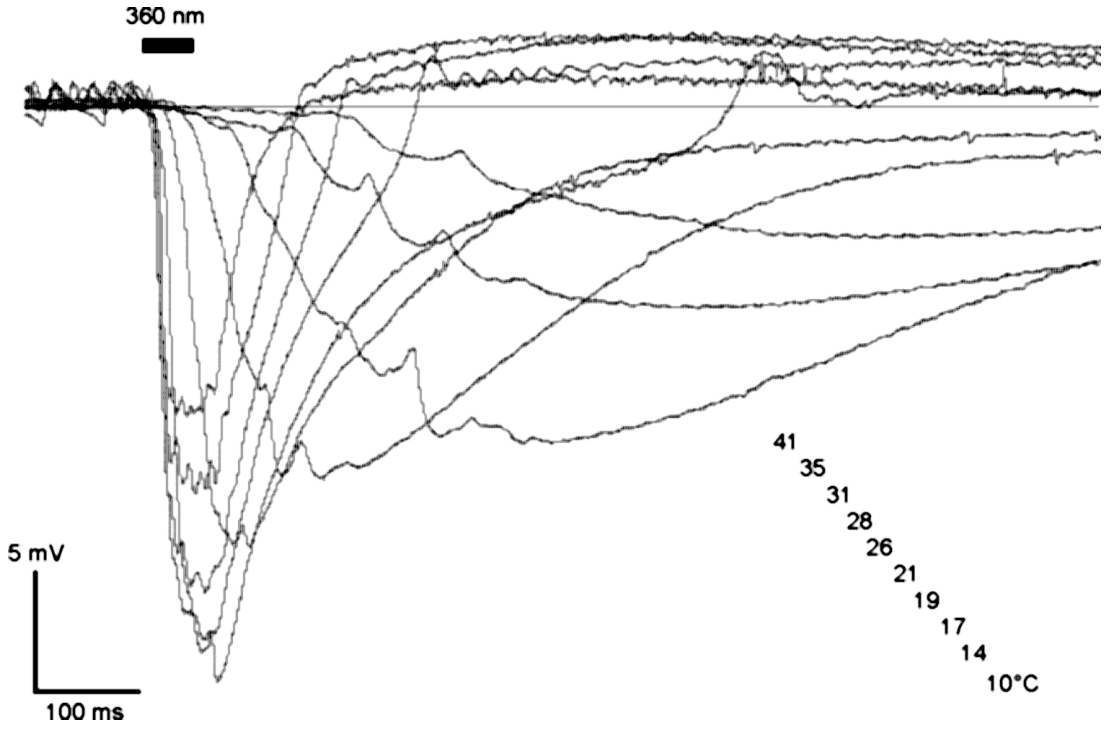

Figure.1: Raw ERGs of *Ascalaphus* at different temperatures

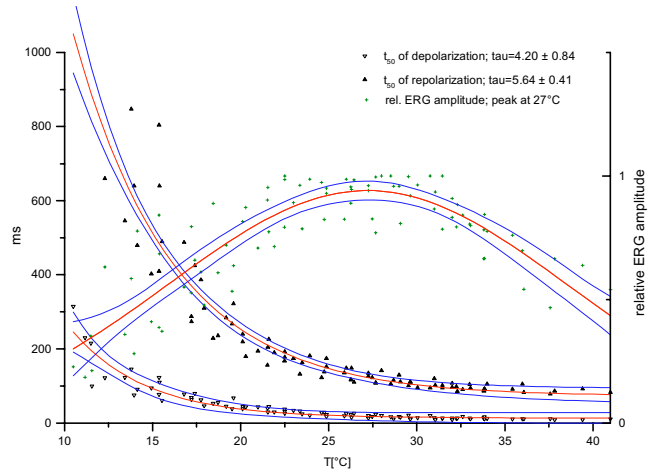

Figure 2: Temperature dependence of ERG parameters: peak amplitude, rate of depolarization and rate of repolarization

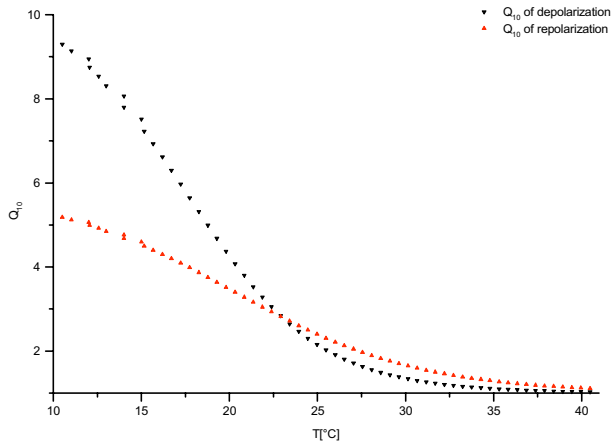

Figure 3: Temperature quotients of *Ascalaphus* ERG.

Results.

Responses to 350 nm/50ms nonsaturating stimuli were measured in terms of amplitude, time to half maximal depolarization and repolarization, respectively. The speed of photoresponse decays exponentially with a "temperature constant" (analogue to time constant, tau) around 5°C. The asymptotes of the exponential fit give an estimate of fastest depolarization (t_{50}dep=14,6ms) and repolarization (t_{50}rep=73ms) times which do not coincide with the peak of ERG (T_{max}=27°C).

Temperature quotients for t_{50}dep and t_{50}rep were calculated from numerical matrices of exponential fits. The curves indicate that the photoresponse is approaching its optimum above 35°C and is dramatically retarded below 25°C. The bottleneck limiting the speed of photoresponse seems to be the repolarization since it exhibits a higher Q_{10} even at slightly suboptimal temperatures.

Conclusions.

Although an old-fashioned method, electroretinography reveals the high thermical and aerobical demands of *Ascalaphus*. The temperature optimum of the animal's vision reaches above 40°C which is in line with the measurement of its body temperature which reaches temperature over 45°C within a few minutes after exposure to direct sunlight.

The present experiments shed new light on previous data that had been obtained at laboratory room temperatures which had obviously posed serious limitations to *Ascalaphus'* visual performance.