Materials & Methods

Figure 2A and 3A provide an anatomical overview of the larval visual system. Stemmata are located at the base of the antenna and positioned laterally on the larval head (Fig. 2A). About 100µm in diameter, stemmata are separated by 1000µm (in contrast, a single adult compound eye is ~1000µm and the eyes are separated by ~600µm). An optic nerve, 20-30µm in diameter, containing visual axons extends rostrally (2500µm) to the larval brain (Fig. 3).

What is the structure of the larval eye?

There appear to be two separate regions within the eye just beneath the lens (Fig. 2A red arrows). We observe pigment lining the outer surfaces of both regions and continuing throughout the base of the stemmata.

Anatomical Results

The pattern of pigmentation encompasses both lobed compartments of the larval eye (Fig. 4). This gives dimensionality to these regions (red outline Fig. 5A). Examination of the lobes at higher magnification reveals an arrangement of ‘fingerlike’ structures (Fig. 4B). These structures have a projection that extends into the base of the eye (Fig. 4C). Putative cell bodies of photoreceptors are seen outlined by pigment grains just beneath each lobe (green outline 4A). The nuclei of this structure is shown at higher magnification in figure 4D. To locate visual processing neuropils in the brain we have begun to trace the axons of the visual cells (Fig. 6).

Do larvae have a phototactic behavior?

Where do visual axons project to in the protocerebrum?

The anterograd staining (Fig. 6) shows that visual axons are confined to the most lateral edge of the nerve bundle entering the larval brain. Within the brain axonal projections appear to go to two separate areas. This might suggest that distinct areas in the brain receive information from the cells of different lobes in the stemmata.

Figure 5 shows preliminary data reflecting the spectral sensitivity of the larval eye. Field potentials were recorded in response to a light stimulus (k = 540nm). The response of the larval shifts in relation to the ~100 millisecond delay of the stimulus. We plan to extend the recordings to the cellular level.

Future Directions

- Extend the anatomical studies to label individual visual cells and trace their projections to identify associated visual areas in the central brain.
- Investigate phototactic response of larvae to different wavelengths of light.
- Electrophysiological study of the larval visual system: Identify the substrate that mediates the phototactic behavior.

References


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