

Olympus E330 DSLR for Photomicrography with Older Design Microscopes

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Jan Hinsch wrote an excellent review article "About the Use of Digital Single Lens Reflex Cameras on Microscopes" in 2004 for the web journal Modern Microscopy, <http://www.modernmicroscopy.com/main.asp?article=33&print=true>. The purpose of this article is to demonstrate the capabilities of the new Olympus Evolt E-330 DSLR for use with older design microscopes to capture the full diagonal of an 18 mm field number eyepiece that is not high eye-point. This camera can be fitted with OM mount film camera lenses



Figure 1

using the Olympus MF-1 adapter. A key requirement I had before purchasing a DSLR was that critical focusing must be possible at the full resolution of the sensor. I asked the Olympus Precision Instruments Group whether Olympus would have a DSLR available with this capability, and learned from them that the new E-330 DSLR would allow a selected area to be displayed at full resolution from the main CMOS sensor for critical focusing. This 7.5 megapixel sensor measures 13 by 17 mm. Before deciding to buy the E-330, I did an experiment with an OM-1 35 mm camera and 28 mm f/2.8 camera lens with a 10X eyepieces that were not high eye-point (eye relief), and determined that vignetting was not evident until the camera lens was stopped down to f/8 and that the camera and eyepiece combination magnified the eyepiece field stop by a factor of 1.16. This experiment and the critical focusing capability led me to purchase the E-330 when it first became available on the consumer market. A key application will be its use on the heavy duty bellows of my macro

system that is sometimes used with a scanning light system shown in my web article: <http://www.modernmicroscopy.com/main.asp?article=60> in Modern Microscopy.

Careful studies with my modified Lomo Biolam microscope using a stage micrometer for the 4X objective and a diatom test slide from McCrone Microscopes and Accessories for the higher power achromatic objectives, indicated that several different eyepiece compensation levels are necessary for best resolution to the edge of the field. The Lomo 10X WF compensating eyepiece was found best for the 10X and 20X objectives in the monocular system shown in Figure 1. This eyepiece is not available in a high eye-point version. A Zeiss kpl eyepiece, with high CDM compensation, was best with the 40X objective. My article on chromatic aberration from mismatched objective and eyepiece combinations has images of a stage micrometer showing that the 4X Lomo objective performs best with a non-compensating eyepiece.¹ This 4X objective was used for demonstrating the field size recording capability of the new E-330 DSLR with a 28 mm f/2.8 lens in the MF-1 adapter versus the same field recorded with a Nikon Coolpix 995 digital camera. A DIN 10X 18 mm FN eyepiece, which does not have a high eye-point and is non-compensating, was used for the comparisons. The test specimen is the wing of a housefly. My modified Biolam with its monocular head was used for this study and is described in an earlier article.² A cable release mount

was made for the E-330 similar to the one made for my Coolpix 995. The microscope setup and mounted E-330 are shown in Figure 1 along with a modified Zeiss 25X stereomicroscope eyepiece used as a Klein loupe over the eyepiece to view the image of the light source and aperture diaphragm formed at the rear element of the 4X objective. The camera is mounted on the rigid macro stand with the front of the 28 mm lens almost touching the eyepiece. A threaded ring with a thin washer of darkened aluminum is used as a light shield and is added at the front of the 28 mm camera lens. The top element of the Lomo Abbe condenser was unscrewed so the lower element could be used to illuminate the full field of the 4X objective. The aperture diaphragm just below

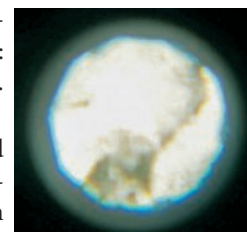
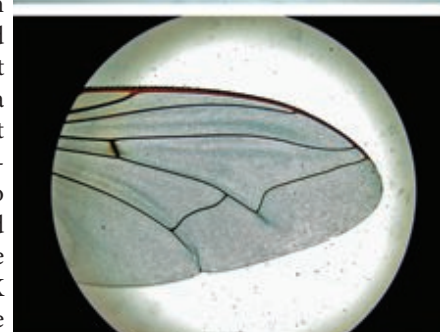
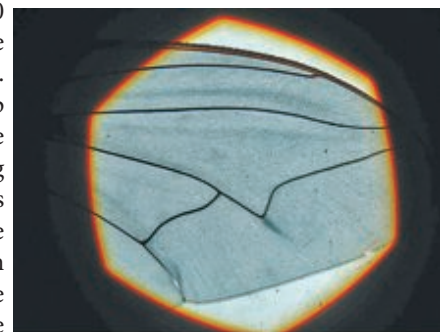


Figure 2



Figures 3, 4, and 5, top to bottom.

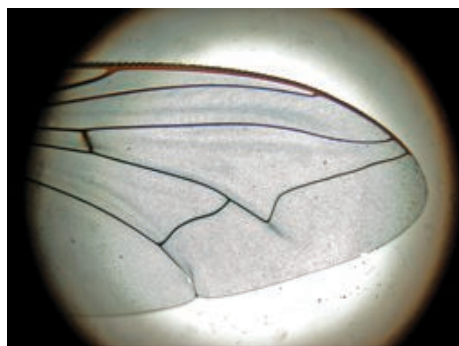


Figure 6



Figure 7

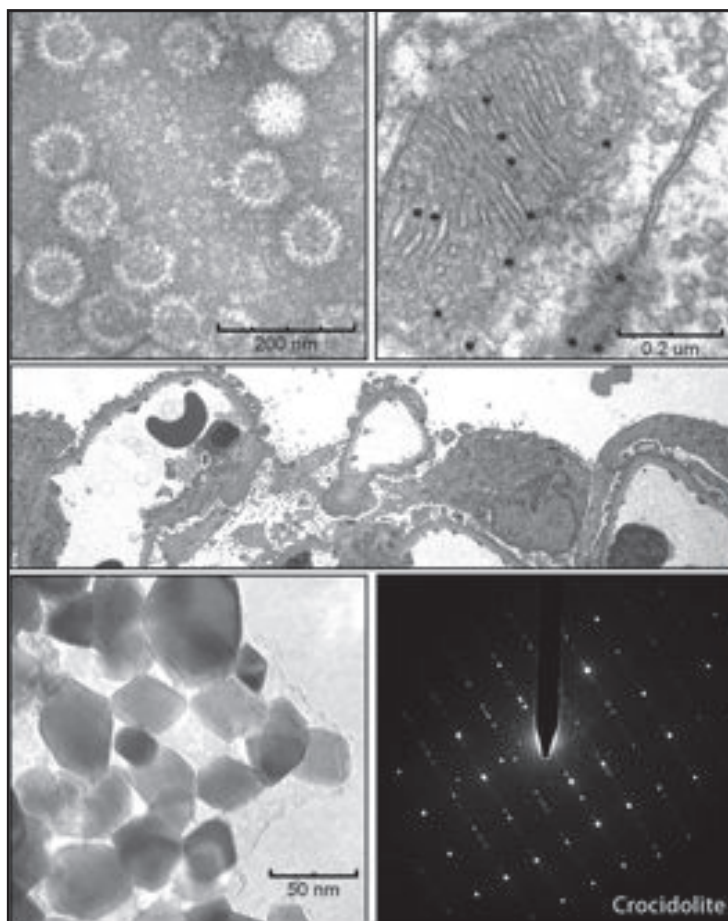
this condenser lens element was left fully open and the aperture diaphragm at the end of the fiber optic light-guide end was imaged at the rear element of the 4X objective as shown in Figure 2, taken with the E-330 and the Klein loupe slipped over the eyepiece. The field diaphragm of the collector lens was focused on the field as shown in Figure 3, also recorded with the E-330. Figure 4 shows the fly wing recorded with the E-330 along with segments of the eyepiece field stop visible in the corners of the image. I centered the ring of vignetting when the 28 mm camera lens is stopped down to align the microscope under the camera lens before fully opening the aperture of the 28 mm lens. The E-330 has a second image sensor in the viewfinder system that can be switched on to provide a live display that includes an indication of the number of stops of over or under exposure for the selected exposure. A correct exposure can be found with few trial exposures based on this reading. These images are displayed on the large LCD on the back of the camera. Figure 5, taken with the Coolpix zoomed to its shortest focal length and focused at infinity, shows the full field of the 4X objective and the imaged field

stop of the eyepiece. There is some darkening from vignetting towards the edge of the field even though the Coolpix lens aperture was fully open. Figure 6 shows this vignetting getting worse as the lens is zoomed to a slightly longer focal length. The lens was further zoomed until the small field shown in Figure 7 was recorded without vignetting. I hope this photo sequence taken with the Coolpix clearly demonstrates the vignetting problem. Jan's article indicates that a high eye-point eyepiece is needed to minimize vignetting with use of a digital zoom lens on a

DSLR and that the full field diagonal of the eyepiece is not recorded. He also notes that the auto-focus does not work when the digital lens is used for photomicroscopy. I look forward to using the E-330 with the trinocular head for the Biolam in high NA darkfield imaging of live water organisms. My tests with the diatom test slide indicate that the Lomo compensating eyepiece should produce significantly better image quality than the Lomo Edupointer eyepiece used with the Coolpix 995 as described in one of my earlier articles.³ It seems from my recent tests with the diatom slide that the magnification changer lenses in the trinocular head provide some CDM compensation along with field flattening. ■

References

- 1 Clarke, T. M. "Chromatic Aberration in Digital Photomicrographs from Microscopes Requiring Compensating Eyepieces"; *Microscopy Today*, Vol 12-No. 4, July 2004, 34-36.
- 2 Clarke, T. M. "Effects of Abbe Condenser Spherical Aberration on Image Quality"; *Microscopy Today*, Vol 13-No. 2, March 2005, 20-25.
- 3 Clarke, T. M. "Fitting a Student Microscope with a Consumer Digital Camera"; *Microscopy Today*, Issue #02-3, May 2002, 15-18.



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