

Photography

This is a huge and varied subject; the below information is based on my own experience but other people's ideas and tips would be welcome. It is assumed that most people will be working with a limited budget!

Microscope types

Stereo dissecting microscope. This is a must for dissecting. For photographic purposes, they offer better depth of field and an 'upright' image. In other fields they are outclassed by even modest compound microscopes. Some SDMs come with an in-built digital camera.

Compound Microscope. These tend to have lighting systems and lens arrangements which yield finer detail. They have poor depth of field and the image is upside down. Some CMs come with an in-built digital camera.

Camera types

35mm SLRs versus **Digital.** Most quality SLRs can be fitted to a microscope with adaptors sold by the manufacturer. A few, such as Olympus, provide additional screens for their cameras to aid focusing when used with a microscope or telescope. Many digital cameras can be fitted to a microscope by adaptors sold by companies such as Anglia Leps

Most digital cameras provide easy video output, which allows you to see things on a TV, very useful for focusing.

An advantage of digital is the immediacy of the images, allowing you to re-shoot if necessary, and the ability to enhance those images on a computer. Slow shutter speeds will make the use of a cable/remote release essential.



Using a DSLR

Technical Aspects

Lighting. SDMs are usually fitted with lamp situated below a ground glass or opaque plastic stage. The transparency of this stage affects the visibility of fine detail. Heavily opaque stages will scatter light and mask fine detail. Viewing fine detail may seem like a good thing, but not always: if you are trying to clearly see the shape of the valves only, the appearance of unnecessary detail can be distracting (see [examples](#)). In addition to the lamp CMs usually have sub-stage condensers with iris diaphragms, which allows greater control over lighting.

Colour balance. The lighting systems on budget microscopes may give a strong orange hue to the final picture. To combat this, use a blue filter between the lamp and stage. Digital users can *additionally* set the camera's white balance setting and make final adjustments in programs such as *Adobe Photoshop* (see [examples](#)).

Vignetting (darkening of the edges). This can be caused by microscope's eye piece or sub-stage lighting. To combat the former, zoom in the camera lens - the effective magnification will increase and image quality may suffer. Sub-stage lighting problems can be reduced by opening the iris diaphragm (if fitted), though this may reduce contrast and render fine detail invisible; and by ensuring that the bulb is fitted centrally and not shifted to one side of its chamber.

Focusing. For digital users, the camera linked to a TV rather than relying on the camera's monitor will prove very useful. It is usually best to set the camera's to infinity and set the focus via the microscope's controls.

Image enhancement (see [examples](#))

Photography - examples

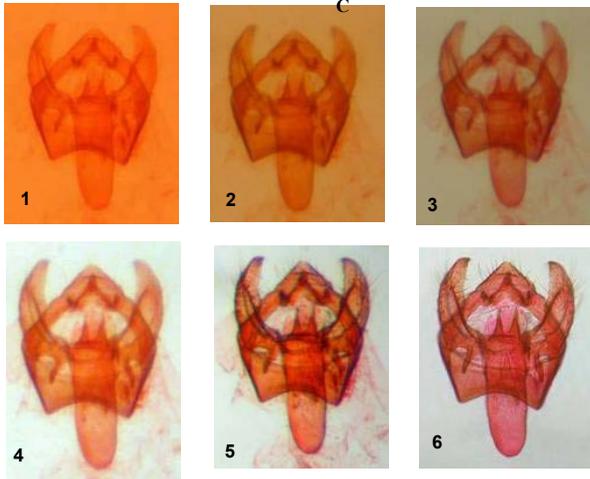
Colour Balance

- 1/ Basic image
- 2/ Camera set to 'tungsten'
- 3/ 'Tungsten' + blue filter
- 4 - 6/ As 3 plus corrected in *Adobe Photoshop*

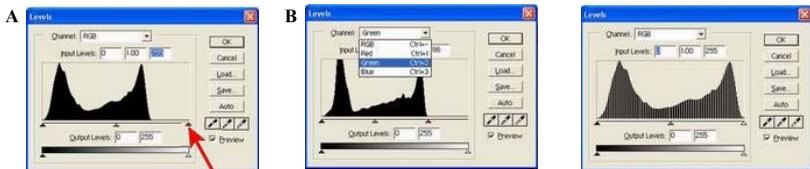
Detail

- 1 - 4/ Stereo dissecting microscope fitted with heavily opaque stage
- 5/ Stereo dissecting microscope fitted with transparent stage, giving better detail
- 6/ Compound microscope - note the finer detail.*

*This is a composite of three images merged in *Adobe*, each focusing on different areas of the structure.



Enhancing Images



Contrast, brightness and colour balance

The final image can be enhanced by using photo-editing software such as *Adobe Photoshop*. Many packages offer an 'instant fix', or 'auto' option to correct colour balance, contrast, brightness etc, but it is often better to do this manually by viewing a histogram. In *Photoshop*, first load the image then either press the keys 'Ctrl' and 'L' together, or go to 'Image' - 'Adjust' - 'Levels', and this will bring up the image's histogram.

In example A, the image is under-exposed and this is indicated by the flat line to the right of the 'mountain'. This can be corrected by sliding the **red** button to the left until it reaches the 'mountain'. This adjusts the red, green and blue (RGB) channels together, but it can be better to adjust each channel individually (example B). Example C shows the finished histogram and should provide a well exposed image. Adjusting the contrast and brightness might lead to some details or features in the image becoming obscured.

Removing blemishes

Use the clone brush (or clone stamp tool in *Adobe Photoshop*) to remove dust, spots, unwanted sections of the image.

Using a DSLR

It is possible to use a DSLR with a microscope to produce high quality images, although you may need to search around for adaptors to connect the two. Image files will be huge, especially when shooting multiple images for stitching together in Photoshop, so you may need to reduce image quality (on the camera menu) unless you have a powerful computer with plenty of memory.

White Balance should be fine tuned manually on the camera (take test shots to give a grey background colour which, when checked in Photoshop, should yield equal RGB values, thus obviating the colour of the microscope lamp).

For larger subjects, such as noctuid genitalia, the microscope eyepiece can be removed, giving low power magnification and allowing the entire structure to be captured by four or five shots.

The camera may allow you to delay shutter operation until mirror vibration has ceased (=AntiShock) and a cable or remote release should always be used.

Right: Olympus E410, OM microscope adaptor, OM - ESsystem adaptor, video output routed through a tv to aid focussing.

B. Goodey



Alternatively....

Try using a DSLR camera instead of a microscope. By adding, in reverse, a short focal length lens to a longer lens you can get high magnification. The longer the prime lens and the shorter the reversed lens the greater the magnification (I think the formula is $\text{long}/\text{short} = \text{magnification}$). Thus, a 50mm lens reversed onto a 200mm lens will give x4 magnification.

The image right was taken with a second-hand 50mm lens reversed onto a 105mm lens and is of *Mythimna unipuncta*, from New Brunswick, Canada.

The reversed lens is used wide open (max aperture) and the prime lens is used to control aperture. In this case, a 50mm lens was at $f1.8$ and a 105mm lens at $f11$. As with every macro shot, shallow depth of field is a problem. The *Mythimna* image comprised of 21 exposures stacked with Helicon Focus.

To get 'microscope level' magnification simply use a low power microscope objective. I use Jessops extension tubes that fit my DSLR. I cut out a cardboard circle to fit the lens end, then painted the inside of the cardboard black; I then cut a hole in the cardboard to hold the lens. For low power I use just the 21mm tube, and for higher magnification I use all three tubes.

Tony Thomas

