



Introduction to Macro Photography

By Emil von Maltitz

A world of photographic potential awaits the photographer who wants to discover the joys of macro photography. From personal observation it seems to have become immensely popular over the past few years as digital photography has made it all that much easier to be able to capture the minutiae of the natural world. But, macro photography is not the easiest of pursuits, and although it does not require a mortgage to pay for exotic lenses, the good equipment does not come cheap. Then, more than any other type of wildlife photography, macro photography requires an understanding of the technical process of capturing images as well as how to manipulate light. Once all this has been achieved the photographer then has to have the patience of Job to create stunning images of the nature's smallest subjects.

Magnification

In macro photography the magnification that we use refers to the size of the subject in relation to the its size on the sensor or piece of film. Therefore a subject with a magnification ratio of 1:1 is reproduced on the sensor at its life size. A ration of 1:2 means that the reproduction on the sensor will be half the size of the subject. Macro actually only refers to photography where the magnification ratio is life size (1:1) or greater. It's only a point of convenience to refer to all close-up photography as 'macro photography'. However the distinction is important as a only a true macro lens will take the magnification at 1:1. A number of camera and lens manufacturers will claim that some of their zoom lenses have 'macro functions', but unless they focus down to 1:1, this is a false claim. They will sometimes focus as close at 1:4 which is pretty good though.

To achieve a magnification ratio of 1:1 the lens does not enlarge the subject as in the case of a zoom lens. Rather, it allows extremely close focusing. Because of the proximity to the subject that is

required, the focal length becomes important. Regardless of the focal length of a true macro lens, it will focus down to 1:1 reproduction. Because of this the traits of a specific focal length become pronounced. These traits are:

- Distance to subject
- Angle of view (how much background is included)
- Depth of field

For macro photographers the distance is critically important. The longer the focal length the more distance between lens and subject is required. A 105mm macro lens usually has a minimum focusing distance of roughly 30cm. A 60mm macro lens, on the other hand has a minimum focusing distance of about 18cm. This means that to achieve the same magnification with the 60mm as with the 105mm the photographer has to be a full 12cm closer to the subject! This can make photographing subjects such as insects extremely difficult as you might not be able to approach close enough to be able to get to 1:1 reproduction.

*From left to right
Nisi Close-up Adapter, Laowa 100mm 2x Macro Lens,
Canon EOS RF 100mm f2.8 and Irix 150mm f2.8*



Field of view also changes dependent on the focal length lens. A shorter focal length will have more of the background apparent in the scene (imagine an up close version of a wide angle lens). The longer the lens the more isolated the subject becomes from the background. This is further emphasised as the depth of field diminishes further with a longer focal length.

Because of the focusing distance there are three primary macro lenses that are available, these being the 60mm, 105mm and 180mm (or 200mm) lenses. Most if not all three focal lengths are offered by the major camera and lens manufacturers. Because of the lens designs they tend to be less expensive at the shorter focal length and more expensive at the longer end. I would personally recommend the 105mm as a first purchase as it is by far the most useful while the 60mm and 180/200mm are fairly specialised.

Equipment

What keeps a number of amateur photographers from trying out Macro photography is often the equipment that is required. In my opinion, one of the most useful lenses that a photographer can possess is a dedicated macro lens (more on what 'macro' means later). A dedicated macro lens is designed to be extremely sharp up close and usually has a large aperture. This makes the macro lens a fantastic portrait lens as well. As a short telephoto they are excellent and offer far more uses than just photographing bugs. Albeit bugs is usually where these lenses excel.

Cheaper alternatives do exist however. Most beginners start out using a set of close-up dioptres that fit to the filter thread of the lens. Their advantage is that they are small, light, cheap and do not decrease the amount of light (slow the exposure) that enters the lens. Their serious drawback is that they degrade

image quality. A few exceptions are the excellent apochromatic close-up lenses produced by Nikon and Canon. These 'filter' are not simple magnifying optics, but are corrected lenses with sometimes more than one element that screw onto the front of the lens. The problem is that the specialised 'filters' are often extremely expensive and are limited in their uses.

A popular alternative to close-up dioptres and lenses is to use an extension tube or bellows. Essentially, the further the rear element of the lens extends from the focal plane, the closer the focusing distance. Extension tubes are relatively inexpensive and can convert just about any lens into a 'macro' lens. Prime lenses work best though. Excellent automated extension tubes are available from Kenko for relatively little cost (certainly cheaper than a dedicated macro lens). The drawback of extension tubes is that they chew up light from the lens. The longer the extension the lower the shutter speed will be.

Bellows are a specialised extension unit that allows photographers to magnify the subject well beyond life-size. They are bulky and cumbersome in the field though. Older units also will not allow coupled metering to the camera. In order to assist with focusing a separate rail is usually built into the bellows unit so that fine focusing can be achieved. This is not the kind of rig that can easily be used while chasing butterflies in the wild!

Because the depth of field in macro photography is so small, focusing rails are often employed when the camera is attached to a tripod. Focusing rails shift the camera and lens back and forth to focus,

To be precise about the amount of depth of field for a macro lens and aperture combination at a reproduction ratio of 1:1

F2.8 – 0.28mm

F4 – 0.4mm

F5.6 – 0.56mm

F8 – 0.8mm

F11 – 1.1mm

F16 – 1.6mm

F22 – 2.2mm

F32 – 3.2 mm

F45 – 4.5mm

Total Depth of field = $2fC(M+1)/M^2$

C = diameter of the circle of confusion which here is 0.025mm as calculated for a 35mm frame.

F = aperture setting

M = magnification where life size (1:1) is



On the left is the affordable Viltrox extension tubes and on the right the specialised Novoflex bellows which even offers autofocus on some camera-lens combinations

rather than focusing via the lens. The lens's focusing is often not accurate enough to be able to focus exactly on the subject.

Lighting can be provided in a variety of forms. Because of the small size of the subjects that require large magnification, it is often necessary to drop down the aperture to a very small aperture in order to obtain any depth of field. A result is that artificial light often has to be introduced to the subject. The tools that are the most useful here are: a mirror, a torch and a flashgun (or multiple flashguns). A small handheld mirror is often all that is needed to get light onto the subject. Alternatively a bright LED torch can also be used to creative effect. The most effective way of getting light onto the scene though is from an electronic flash.

The problem with electronic flash is that it isn't the most natural looking of light sources. To alleviate the flat look of this lighting it therefore needs to be modified in some way.

Lighting

Lighting is a crucial aspect of artistic macro photography. Because of the complexities of the equipment involved it is by and large necessary to introduce additional light sources to the ambient light. The trick though is to modify both additional as well as ambient light sources so as to create dramatic lighting.

If shooting still subjects such as flowers it might be necessary to soften the light created by the sun. It is a truism that flowers are best photographed under overcast lighting. However, the weather does not always play into the photographers hand, so she must needs be carry a cloud with her in the form of a diffusing panel. A diffusing panel is essentially a disk or rectangle of semi opaque material that is placed between the light sources, in this case the sun, and the subject. This softens the light and reduces strong contrast. As an added bonus it can also serve to reduce wind by creating a windshield. True diffusers like those produced by Elinchrome and Lastolite are extremely expensive though. When starting out on a budget look for vehicle dashboard shades made from white semi-opaque material. These cost next to nothing, achieve roughly the same type of diffusion and are easy to acquire.



The lighting setup offered by Olympus...a favourite brand among macro photographers as the size of the sensor allows for small and light setups that often go way closer than 1:1

Introducing light is the next step and is a little harder than diffusing it. A basic start for most amateurs is to use the pop-up flash on their cameras. The problem is that this creates harsh top lighting that is often shadowed out by the length of the lens (remember that the lens extends quite far from the body as it focuses closer). The first step then is to get the flash off the camera. As soon as this is done a whole array of lighting options presents itself. Side-lighting in particular is far more natural than the flat lighting that occurs from using either the pop-up flash or a flashgun attached to the camera's hotshoe.

The problem with side-lighting is that harsh shadows can appear on the opposing side of the flash. Traditionally the easiest way to produce shadowless subjects is to use a ring-flash – a round flash tube (or two opposing flashtubes) that mounted onto the front of the lens. Again, the images may be perfectly exposed, but lack any 3-dimensional shadowing. Modern equivalents to the ring flash come in the form of two (or more) tiny flashes that mount to the lens's filter thread and by virtue of being more than one flash can have their output altered independently.

Another approach to lighting and one which I prefer to follow is to use a softbox on the front of the flash. The basic premise is that if the light source is greater than the subject, the light will be softer and rounder. The smaller the light source in relation to the subject, the harder and harsher the quality of the light (read the accompanying article on macro lighting for more information). By using a large softbox for a small subject the light literally wraps around the side of the subject, leaving soft shadows with detail left intact rather than hard inky black shadows.

It is still possible to get good results without the use of a softbox. One particularly noticeable concern with undiffused light is the shiny 'hotspot' that can occur on the subject. This can be mitigated through the use of a polariser on the lens. To get light that is both soft and directional (non 3-dimensional) use a second polariser on the flash head. By crossing the two polarisers (setting the polariser mark so that they are at 90 degree to each other) it is possible to eliminate all reflected highlights as well make insect exo-skeletons become almost translucent.

Basic Settings

An understanding of the law of reciprocity is a given when approaching macro photography. Using the histogram on the back of the camera allows a quick and easy way to verify and correct exposure as well as check depth of field and focus. Expect a lot of duds!

Switch autofocus off! No matter how good the autofocus system that the camera has it will be fooled when you get down to 1:1 magnification. Rather use manual focus and use your body or a focusing rail to focus.

Learn how to mix ambient light with flash light in the manual mode. When you are using flash it is far easier and more predictable to start shooting in manual flash and manual exposure. As a test I will often photograph the tips of my fingers at 1:1 to check settings and then start chasing insects. As a starting point I often find that a good exposure to start with is 1/250th of a second at f11 on ISO 200 with flash set to 1/16th power. A quick test from this setting allows me to gauge whether I need more depth of field, more introduced light, more ambient light or more speed (often the last thing required).

Let's say everything is perfect but I need greater DOF. Increase the aperture to f16 and increase flash out-put to 1/8th power. If this results in the background becoming too dark, bring flash output back to 1/16th but increase the ISO to 400. Essentially when using flash and ambient light:

- ISO and shutter speed affect ambient light (higher ISO makes backgrounds brighter)



- Aperture affects depth of field primarily, but has a linkage to brightness
- Flash affects amount of light on subject. Bear in mind that if the flash is stronger than the ambient light the background will go darker (sometimes completely black).
This is a fairly simplistic way of looking at these variables, but it makes it easier to understand what to change when you look at the LCD or histogram.

Conclusion

There are a number of ways to get close to small subjects. Patience though is the overriding skill that is required. More so than any other wildlife photography is an understanding of light and your equipment required. Beyond composition macro photography is technically demanding, but quite possibly one of the most rewarding fields of wildlife photography.