Advice 4all

Microphotography

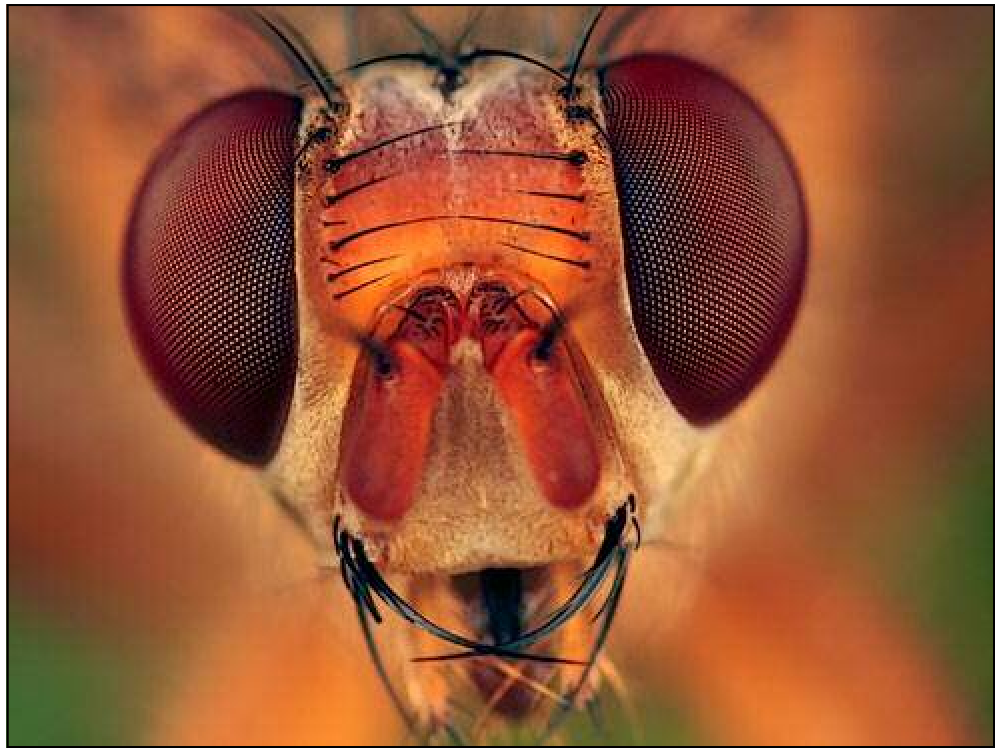
by Huub de Waard

One of the most popular books that I read during my childhood was Eric in the Land of the Insects, written by the Dutch author Godfried Bomans. In this humorous fantasy, nine-year-old Eric enters the landscape painting that hangs on his wall and he discovers a world of man-sized wasps, bees, butterflies and other insects that is stunningly similar to the world of humans. The book made such an impression on me that I have always wanted to explore such a world full of wondrous creatures myself. Once photography became a part of my life my world was populated with grasshoppers, spiders, snails, flies, dragonflies and butterflies—Eric's world.

Magnification describes the relationship between the actual size of the subject and the size of its image on the sensor of the camera. Photographing a 3 cm (1.18 inch) long blue-tailed damselfly so that its image size is 1 cm (0.39 inch) on the sensor means that the magnification is 1/3 (1:3) life-size. Dividing the size of the subject's image on the sensor by the actual size determines the magnification. At 1:1 life-size, the size of the subject on the sensor is as big as it is in real life. Macrophotography is restricted to magnifications in the order of 1:10 to 1:1 life-size. When this magnification is reached, shooting from life-size to modest magnifications of up to 20 is called microphotography.

A jungle out there

The world of insects, spiders and other small forms can be enjoyed on any beautiful day from early spring until late autumn. I can step out of my house on any sunny morning with a cup of coffee and leisurely browse the garden and see where the action is. Or I can choose my spot and watch and wait. And with a little patience, insects and spiders will show themselves and sometimes seem to pose for the camera. Watching the world of gardens in this way quickly reveals that it is truly "a jungle out there" – a jungle of small predators



and preys striving for survival. Walking through any flower garden, you're likely to see bees, hoverflies, and any number of unrecognized insects flying around or walking upon the petals and blossoms of the beautiful flowers. Microphotography can uncover amazing details of the mysterious world of insects. And yet, this amazing world of insects is right outside the door of virtually every home.

Insects generally have two things in mind: to get on with the task at hand and avoid getting eaten. The task at hand might be finding food, mating, or just basking in the sunshine. This means that insects are somewhat predictable. Bees, butterflies, and similar insects, for example, might be just bumbling about from flower to flower. One of the first things you'll notice is that some insects are extremely skittish, like butterflies, damselflies, and dragonflies, while others aren't bothered by your presence at all. You'll see that some insects are constantly moving about, such as ants and bees, where others prefer to sit still for extended periods - many spiders and assassin bugs. And others still, like leafhoppers and plant hoppers, don't seem to mind being photographed, but will shyly turn their back on you, forcing you to change position constantly. The point is that you should invest some time getting to know the common behavior of your tiny subjects and how they sense their environment before firing the first frame.

Approaching Insects

Although most insects do not have orifices in their body for picking up sound vibrations, many use parts of their body, such as their wings, antennae, or special hairs, like TV antennae to detect vibrations in the environment or in the air. Any errant movement on your part could cause you to lose a shot, so be sure to tread carefully when approaching your subjects. Your job is to make yourself non-threatening. The first thing you want to do is to move very slowly. Look before you move, look at where you place your

feet, look at where your equipment is, and most of all plan where you are going to put the front of your lens. Many potentially good shots have been ruined by the front of a lens bumping a branch or leaf where an insect was resting, causing it to flee.

Most insects have a view of the world that is very different from ours, because their eyes are built unlike those of vertebrate eyes. Insects such as the housefly, the hornet, the butterfly, and the beetle, have what we call compound eyes. These eyes are made up of many separate units called ommatidia. Each ommatidium samples a small part of the visual field. Having multiple ommatidia allows the animal to easily detect motion. Some, like the dragonfly, have as many as thirty thousand units per eye, each with its own lens. With a compound eye the insect sees a mosaic image. This looks something like the highly magnified dots of a newspaper photograph. Because the lenses in the insect's eyes have a fixed focus, and can't be adjusted for distance, insects see shapes poorly.

As an object moves across the visual field, ommatidia are progressively turned on and off. Because of the resulting "flicker effect", insects respond far better to moving objects than stationary ones. Honeybees, for example, will visit wind-blown flowers more readily than still ones. Houseflies and dragonflies have eyes that cover most of their head. This gives them almost 360 degree vision, enabling them to see predators coming from any direction. Most insects can see some color. While our eyes see a full spectrum of wave lengths from red to violet, many insects see a limited range of colors. The colors they detect are the ones most useful for finding food and shelter.

It is known that insects, especially flying insects, will try to escape from a predator by a simple escape reflex based on the direction and the velocity of a moving shadow or object. If a critical velocity is exceeded, the insect will try to fly away from the direction of the threat. Slow moving objects or shadows often do not trigger this reflex. The lesson learned is that the best way to approach an insect is to move slowly and gently. Most of all, avoid casting your shadow on the insect.

Affordable Accessories and Options

Strictly speaking, a lens is categorized as a macro lens only if it can achieve 1:1 magnification. Microphotography can be undertaken by normal macro lenses equipped with modestly priced equipment. A lens' minimum focusing distance is the closest distance your macro lens will allow you to get to your subject while still maintaining sharp focus. A low-budget method to decrease the minimum focusing distance is to extend the distance between the lens and the sensor by inserting extension tubes or a continuously adjustable bellows. Both the extension tubes and the bellows do not contain optical elements. The further the lens is from the sensor, the closer the minimum focusing distance, the greater the magnification, and the darker the image given the same aperture. Tubes of various lengths can be stacked, decreasing lens-to-subject distance and increasing magnification. Extension tubes and bellows can be used for different lenses. A small disadvantage is that the use of extension tubes and bellows may not preserve autofocusing, auto exposure and auto aperture operation.

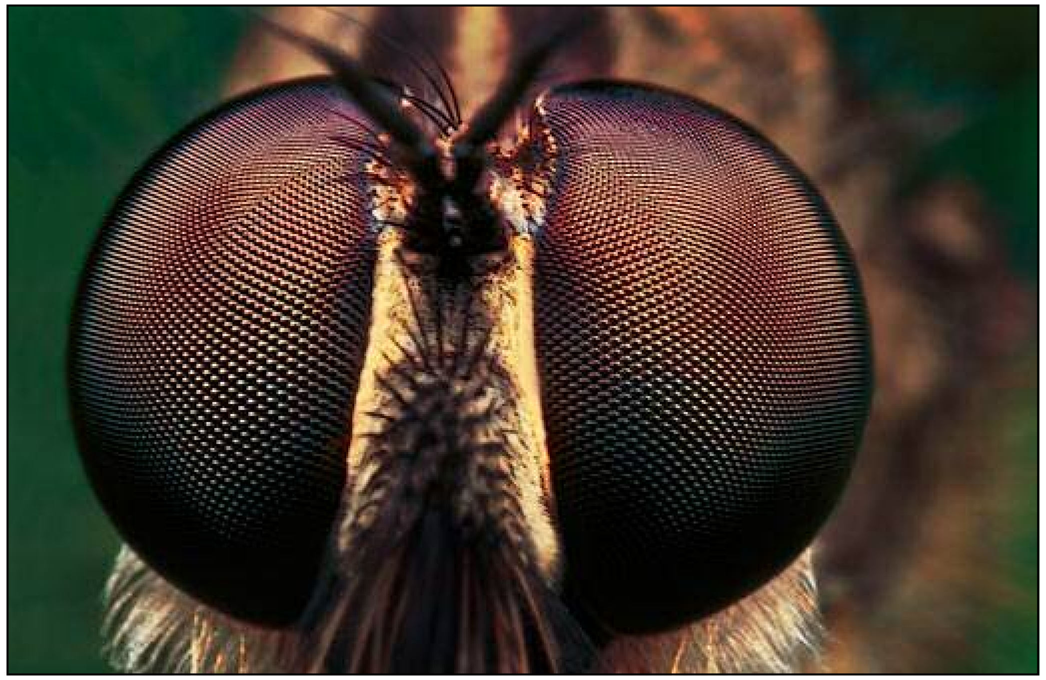
The maximally obtainable magnification can be calculated with the following simple equation:

(D (length of the set of extension tubes or the bellows) + F (focal length of the macro lens)) ÷ F = magnification.

For Example: Adding a set of extension tubes with a total length 0f 60 mm to a 60 mm macro lens will give maximally a magnification of (60+60) ÷ 60 = 2.

By adding a teleconverter, an even greater magnification can be achieved. Application of a 2x teleconverter produces a maximum magnification of 4 and 2 stops loss in light intensity. Adding more glass means a drop in quality and quantity of light transmission, the extent of which depends on the quality of the particular teleconverter you're using.

Placing an auxiliary close-up lens (or close-up "filter") in front of a macro lens is another option. Inexpensive screw-in or slip-on attachments provide close-focusing at a very low cost. Some two-element versions are qualitatively very good while many inexpensive single element lenses exhibit chromatic aberration and reduced sharpness of the resulting image. When you use macro lenses with different diameters, for



each macro lens a close-up lens has to be purchased separately. Most close-up lenses are marked with a +d number in diopter unit, the power of the lens. The diopter (or power) of a lens is defined as 1000 ÷ Fd, where Fd is the focal length of the lens measured in mm. Thus, a lens with a focal length of 50mm has a diopter of +20 = 1000 ÷ 50, and a +4 diopter close-up lens has a focal length of 250mm = 1000 ÷ 4.

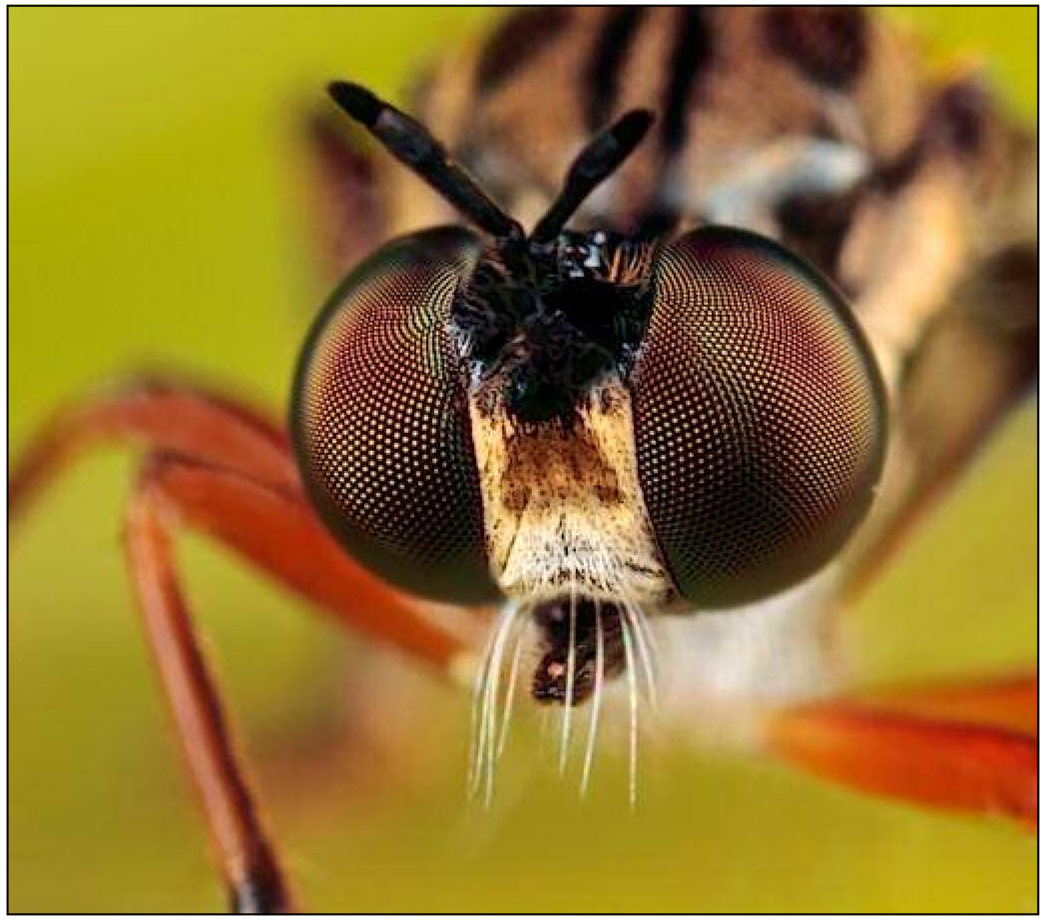
The maximally obtainable magnification can be calculated with the equation (2F + Fd) ÷ Fd.

For Example: coupling a +20 diopter lens with a 60 mm macro lens produces maximally a magnification of (2*60+ 50) ÷ 50 = 3.4.

An interesting alternative is the reverse lens technique which can be accomplished by mounting a lens with focal length Fr in reverse, in front of a normally mounted lens of greater focal length F, using a macro coupler which screws into the front filter threads of both lenses. The maximally obtainable magnification can be calculated with the equation F ÷ Fr. Depending on the quality of the reversed mounted lens, a drop in quality and quantity of light transmission may negatively influence the image quality. All discussed techniques can be used in conjunction to obtain even larger magnifications.

Composition

Composition is more difficult for microphotography than for other types of nature photography.
Your subject might be an insect or a spider sitting on a difficult-to-reach place. Add the fact that you need to approach very carefully to not disturb your subject and you have a bit of a tricky situation. There are no golden rules to help you solve this one. Play around with composition until you get something that works. In microphotography, you want to simplify your image as much as you possibly can. Fill up as much of your frame as possible with the subject. Have your focus as sharp as possible and don't be afraid to experiment with different angles to find the one with the most aesthetic appeal. Photos at high



magnification have a corresponding shallow depth of field, so precise control over the location of focus is critical. This requires not only artistic decisions about what part of the subject should be tack sharp, but also technical decisions about how to make the most of this sharpness.

Fortunately, the location of sharpest focus appears much more pronounced in the viewfinder when the subject is under high magnification. However, just because it's easy to see doesn't necessarily mean that it's also easy to position. Even small errors in a camera's autofocus can be disastrous for an image. This should only be used as a rough guide; precision adjustments should almost always be done using manual focus. It's almost a universal rule that the subject's eye(s) should be the location of sharpest focus and should have a well-chosen position within your composition. For maximal sharpness throughout, adjust the angle of your camera so that the plane of sharpest focus aligns with the head/plane of your subject. If you're off by a fraction of a degree, the complete subject disappears from view.

In microphotography, the background is often so out of focus that it appears as a solid or smoothly varying patch of color. It's important to choose a background which complements the color and tone of your foreground subject. Fortunately, one can often pick a different background by simply shifting the camera's vantage point. One should also take care to avoid placing distracting out of focus highlights or other objects behind the subject.

Your final microphotography image should display fascinating details which are unfamiliar to us in our everyday lives.

Focusing

Working with large magnifications means that the subject is only a few centimeters in front of the lens. During the day time insects move from feeding place to feeding place or are hunting. They stop only for very short periods of time at a specific place to forage, which means that there is no time to set up a tripod. One needs to hand-hold the camera to make the photos. Light is lost when using macro lenses, extension tubes and teleconverters. As magnification increases, depth of field decreases rapidly. Due to loss of light and depth of field considerations, it is advisable to use a ring flash or twin lite flash when shooting micros. It will allow you to shoot at a reasonable speed, yet enable you

to use a small aperture for sufficient depth of field and a fast shutter speed (e.g. 1/200 sec) to capture moving insects. Magnifying the image also magnifies any movement of the camera and the subject, so it becomes far more challenging to make super sharp images.

Because I am hand-holding a relatively heavy and bulky setup, it is not possible to focus using the lens focusing ring, which also determines the magnification. Rather, I pre-set the focusing ring based on how much magnification I want. Once the focus is set, I will physically move the lens, mounted on the camera body, back and forth until the facets in the compound eye(s) of my subject are in perfect focus in the viewfinder. This is the tricky part, obviously, as a fraction of a millimeter can significantly affect the focus. For instance, at five times life-size the depth of field of the MP-E 65 mm at f/16 is 0.269 mm. For higher magnifications, the situation is even worse. In order to stabilize the whole setup, I'll rest my elbow on my knee or both elbows on the ground. As soon as I see perfect focus being achieved, I'll press the shutter button to take a photo.