How to photograph the micro world

With spring just around the corner, microphotography expert **Huub de Waard** shares some top technical advice on how to photograph insects in extreme close-up

One of the most inspirational 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 a landscape painting that hangs on his wall, and he discovers a world of man-sized wasps, bees, butterflies and other insects, which is amazingly 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 became populated with grasshoppers, spiders, snails, flies, dragonflies and butterflies – Eric's world.

Microphotography involves taking photos of extremely small objects that are very difficult to see with the naked eye, with the objective to make them look huge. Microphotography shows much greater detail than macro photography, for example the different kinds of facets in a compound eye. Microphotography allows for greater magnification – the main reason that it is used to photograph very small subjects, such as insects that measure less than one millimetre.

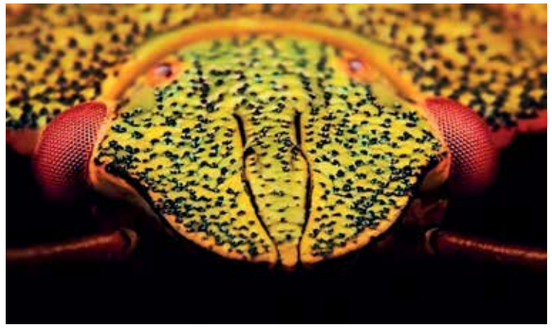
The compound eyes of insects, consisting of a large number of ommatidia, have always fascinated me. To uncover as much detail as possible, I photograph insects so extremely close that they appear to be gigantic. At that scale, insects of the same species look very different, and each insect seems to have its own character. I am very interested in the behaviour of insects, and only take pictures during the daytime period when they are actively foraging.

A JUNGLE OUT THERE

The world of insects, spiders and other small forms is best 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 to 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 nature in your garden in this way quickly reveals that there truly is 'a jungle out there' – a jungle of small predators and tiny creatures striving for survival. Walking through any flower garden, you're likely to see bees, hoverflies, and any number of unrecognised insects flying around or walking upon the petals and blossoms of beautiful flowers.

Microphotography can uncover amazing details of the mysterious world of insects. And yet, this incredible world is right outside the door of virtually every home.

above Meadow froghopper. Leafhoppers and plant hoppers don't seem to mind being photographed, but will shyly turn their back on you.
Magnification 8:1, ISO 100, 1/250sec at f/10



above Frontal portrait of a green shield bug. The subject's eye(s) should be the point of sharpest focus. Precision adjustments should almost always be done using manual focus.
Magnification 6:1, ISO 100, 1/250sec at f/14

Invest some time getting to know the common behaviour of your tiny subjects

Common damsel bugs are considered helpful species in agriculture because of their predation of many types of crop pests, such as cabbageworms, aphids, and lygus bugs.
Magnification 8:1, ISO 100, 1/250sec at f/9

Understanding insects

Insects generally have two things in mind: to get on with the task in hand and to avoid getting eaten. The task might be finding food, mating, or just basking in the sunshine. This means insects are somewhat predictable. Creatures such as bees and butterflies, 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, for example. 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 constantly change position. The point is that you should spend time learning about the habits and behaviour of insects, as you would for any other wild species, before getting out there with your camera.

PRO TIP

» **Invest some time getting to know the common behaviour of your tiny subjects and how they sense their environment before firing the first frame.**

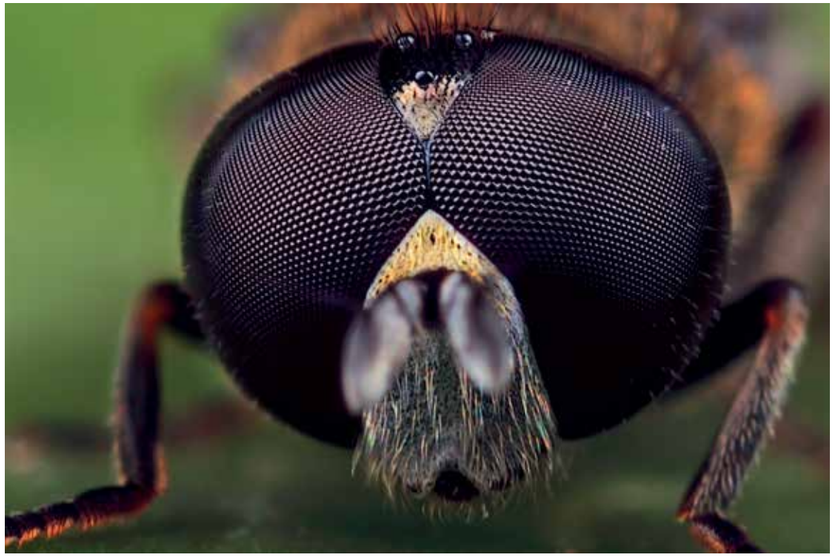
MICRO AND MACRO

Magnification describes the relationship between the actual size of the subject and the size of its image on the sensor of the camera. For example, photographing a 1.18in-long blue-tailed damselfly so that its image size is 0.39in 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.

Macro photography 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. Microphotography is the extreme form of macro photography, dedicated to the photography of very small subjects.

APPROACHING INSECTS

Although most insects do not have orifices on their bodies 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 subject. Your job is to make yourself non-threatening. The first thing you want to do is to move very slowly. Look before you move, be aware of where you are placing 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.



Small male Cheilosia hoverfly standing on a leaf. I combined the Canon extreme macro lens MP-E 65 mm f/2.8 and a 2x teleconverter to achieve a maximum magnification of 10:1. *Magnification 8:1, ISO 100, 1/250sec at f/8*

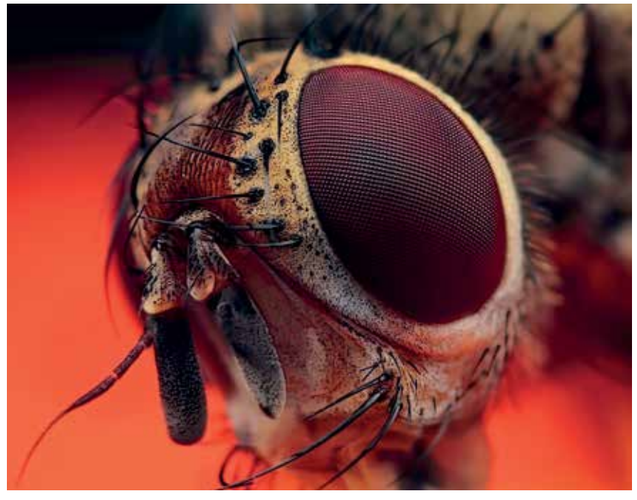
Don't get the buzz-off

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 carefully. Most of all, avoid casting your shadow on the insect.

A bug's eye view

Most insects have a view of the world that is very different from ours, because their eyes are built differently to vertebrate eyes. Species such as houseflies, hornets, butterflies and beetles, have what we call compound eyes, made up of many separate units, called ommatidia. Each ommatidium samples a small part of the visual field. Having multiple ommatidia allows the creature to easily detect motion. Some insects, like the dragonfly, have as many as 30,000 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 do not see shapes clearly.

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° vision, enabling them to see predators coming from any direction. Most insects can see some colour. While our eyes see a full spectrum of wavelengths, from red to violet, many insects see a limited range of colours. The colours they detect are the ones most useful for finding food and shelter.



Flies like this small flesh fly (*Calliphoridae*) have eyes that take up most of their head. This gives the flies almost 360° vision, enabling them to see predators coming from any direction.
Magnification 8:1, ISO 100, 1/250sec at f/8

AFFORDABLE ACCESSORIES

Strictly speaking, a lens is categorised as a macro lens only if it can achieve 1:1 magnification. Microphotography can be undertaken using normal macro lenses equipped with modestly priced accessories. 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.

Huub's gear

Canon EOS 7D with Canon macro lens MP-E 65mm f/2.8, Canon Macro Twin Lite Flash MT-E 24EX and a Canon 2x teleconverter for magnifications larger than 5:1.

»Extension tubes and bellows

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 continuously adjustable bellows. Neither of these 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 their use may not preserve the autofocusing, auto exposure and auto aperture functions within the camera.

The maximum 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 of 60mm to a 60mm macro lens will give maximally a magnification of **(60+60) ÷ 60 = 2**.

»Teleconverters

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 teleconverter you're using.

I photographed the wolf spider so extremely close that it seems to have its own character. *Magnification 10:1, ISO 100, 1/250sec at f/6.4*

»Close-up lenses

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 offer very good quality, while many inexpensive single element lenses exhibit chromatic aberration and reduced sharpness in the resulting image. When you use macro lenses with different diameters, a close-up lens has to be purchased for each macro lens. Most close-up lenses are marked with a +d number in diopter unit, the power of the lens. The diopter of a lens is defined as 1000 ÷ Fd, where Fd is the focal length of the lens measured in mm. Therefore, 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 **$(2F + F_d) \div F_d$**.

»Reverse lens technique

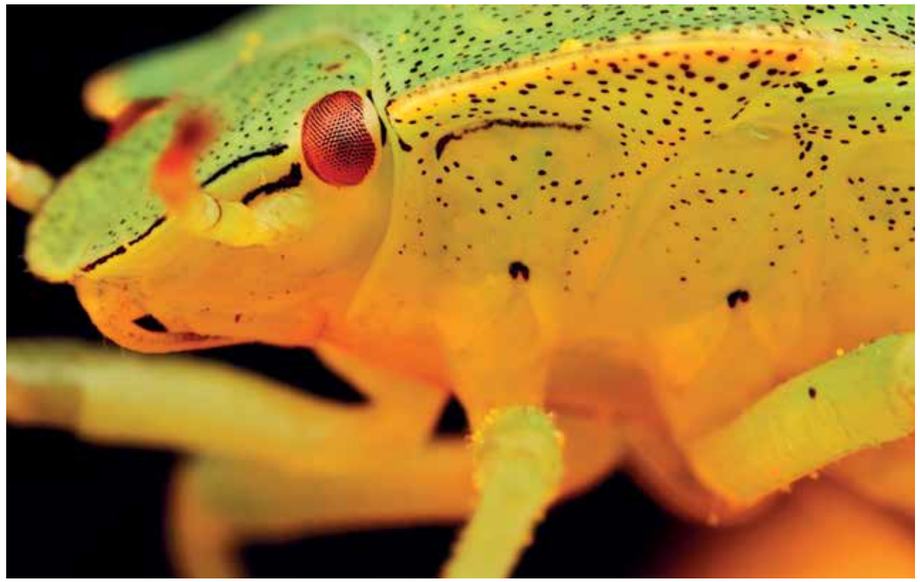
An alternative is the reverse lens technique, where you mount a lens with focal length F_r in reverse, in front of a normally mounted lens of greater focal length F. It requires the use of a macro coupler, which screws into the front filter threads of both lenses. The maximum obtainable magnification can be calculated with the equation **$F \div F_r$**. The quality of the reversed mounted lens may cause a drop in quality and quantity of light transmission, reducing the final image quality. ›

Microphotography can be undertaken using normal macro lenses equipped with modestly priced equipment

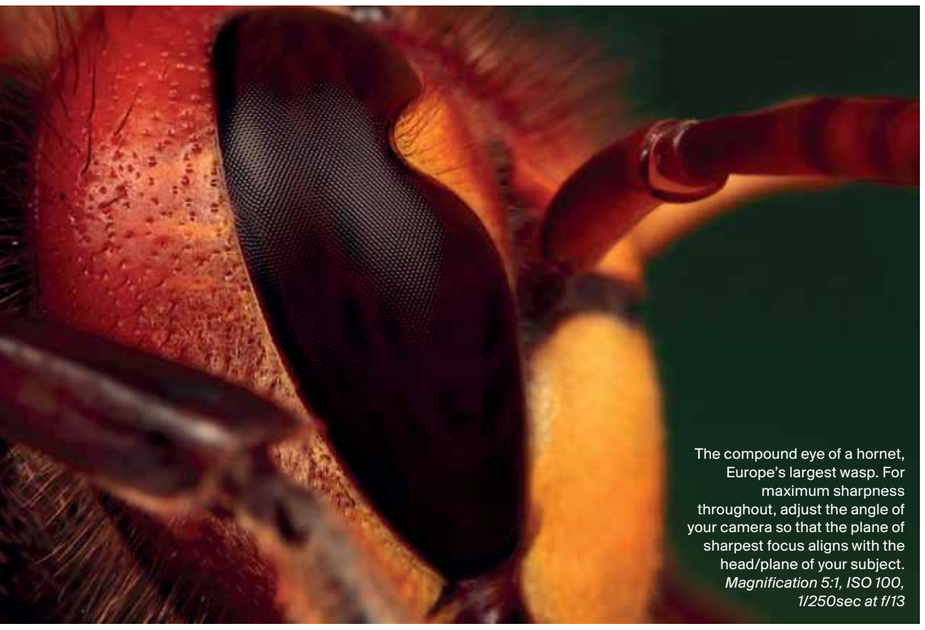
COMPOSITION

It can be difficult to get the composition right when shooting images with a high magnification compared with 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 avoid disturbing 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. With 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. Photographs 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 pin-sharp, but also technical decisions about how to maximise this sharpness.



above In microphotography, you want to simplify your image as much as you possibly can. Fill as much of your frame as possible with the subject. At this scale, the green shield bug appears gigantic.
Magnification 5:1, ISO 100 and 1/250sec at f/14



The compound eye of a hornet, Europe's largest wasp. For maximum sharpness throughout, adjust the angle of your camera so that the plane of sharpest focus aligns with the head/plane of your subject.
Magnification 5:1, ISO 100, 1/250sec at f/13

Getting it sharp

Fortunately, the location of sharpest focus appears much more pronounced in the viewfinder when the subject is under high magnification. Just because it's easy to see, however, doesn't necessarily mean that it's 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 eyes should be the location of sharpest focus and should have a well-chosen position within your composition. For maximum 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 a fraction, the complete subject disappears.

Background considerations

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

right Juvenile grasshopper. It's important to choose a background that complements the colour and tone of your foreground subject.

Magnification 6:1, ISO 100, 1/250sec at f/11

FOCUSING

Working with large magnifications means that the subject is only a few centimetres in front of the lens. During the daytime, insects move between feeding places, or are hunting. They stop only for very short periods to forage, which means there is no time to set up a tripod. Light is lost when using macro lenses, extension tubes and teleconverters. As magnification increases, depth of field decreases rapidly. To get around this, it is advisable to use a ring flash or twin 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. 1/200sec) 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 handholding a relatively heavy and bulky setup, it is not possible to focus using the lens focusing ring, which also determines the magnification. Instead, 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 millimetre can significantly affect the focus. For instance, at five times life-size, the depth of field of the MP-E 65mm at f/16 is 0.269mm. For higher magnifications, the situation is even worse. In order to stabilise the whole setup, I'll rest my elbow on my knee, or both elbows on the ground. As soon as perfect focus is achieved, I press the shutter.

above Small male Cheilosia hoverfly. Working with large magnifications means that the subject is only a few centimeters in front of the lens. One needs to handhold the camera and use a ring flash or twin flash when shooting pictures.
Magnification 10, ISO 100, 1/250sec at f/6.4

PRO TIPS

» **Insects 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. It is necessary to handhold the camera to make pictures.**

» **Due to loss of light and depth of field considerations, it is advisable to use a ring flash or twin flash when shooting micros. A twin-flash system will produce a more natural lighting situation and the results are often more appealing because there is more dimensionality to the image.**

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

» **Play around with composition until you get something that works. Fill up as much of your frame as possible with the subject.**

» **It's almost a universal rule that the subject's eye(s) should be in sharpest focus and should be well positioned within your composition. Precision adjustments should almost always be done using manual focus.**

TAKE PART!

For a chance to win a 16GB Samsung memory card, enter your macro and micro photographs. See page 119 for details