



Fig. 1: Close-up of a cyme of *Euphorbia piscidermis* M.G.Gilbert

Digital stereo macro photography + photo stacking: a modern tool for botanic studies

by Hans Frohning

Everyone dealing with macro photography knows the problem: the depth of field decreases dramatically the smaller the subject becomes. By closing the lens (higher aperture values) the depth of field increases, but at the same time the overall sharpness decreases due to diffraction. The necessary compromise often leads to very unsatisfactory results. Modern digital photography makes it possible to overcome those limitations. The magic tool is photo stacking (also known as focus/image/or frame stacking). With this method a series of shots are taken with varying

distances between camera and subject. Each shot has the depth of field at a different "slice" of the subject. With the help of special software, all these frames are fused to a single image which is entirely in focus. The number of frames necessary can be 2 or 3, 10 or 30 or even more than 200.

The least problem with diffraction softening occurs when the lens is fully open. But no lens is perfect. The lower the aperture values, the more imperfections of the lens will distort the picture. So a compromise has to be found.



Fig. 2a-d: Different stages in the development of a cyathium of *Euphorbia schoenlandii* Pax

Best results can only be obtained with the most suitable aperture. This aperture depends on the camera and the lens, the size of the sensor and the size of the subject to be photographed. There is no way to calculate it, one has to find out the best results for each size in test series. When the right aperture is found, one can calculate the depth of field considering the required resolution. And according to the calculated depth of field the camera has to be moved. That can be from a small fraction of a mm to several cms. There are many programmes for photo stacking on the internet. I use Combine ZP from Alan Hadley.

When such an image with full focus is printed on a paper or shown on a screen, there can be a problem of perception: if it depicts a familiar flower it may be possible to discover minute details never noticed before. But if it shows for example a unknown bell shaped blossom, it may not be possible even to recognize that

it is bell shaped, even less how deep it is. It may look like a cake because everything is evenly in focus and the size is unknown too.

The way out is stereo photography. In 3D, subjects can be seen more clearly and also in the 3rd dimension. It makes really terrific pictures of small flowers. Two years ago I started with photo stacking and 3D and since then my interest in small flowers increased greatly. I learned a lot about them because now I could see and document minute details I had never noticed before. Camera requirements: Manual setting must be possible for focus, aperture and shutter speed.

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